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Volume 50, No. 22

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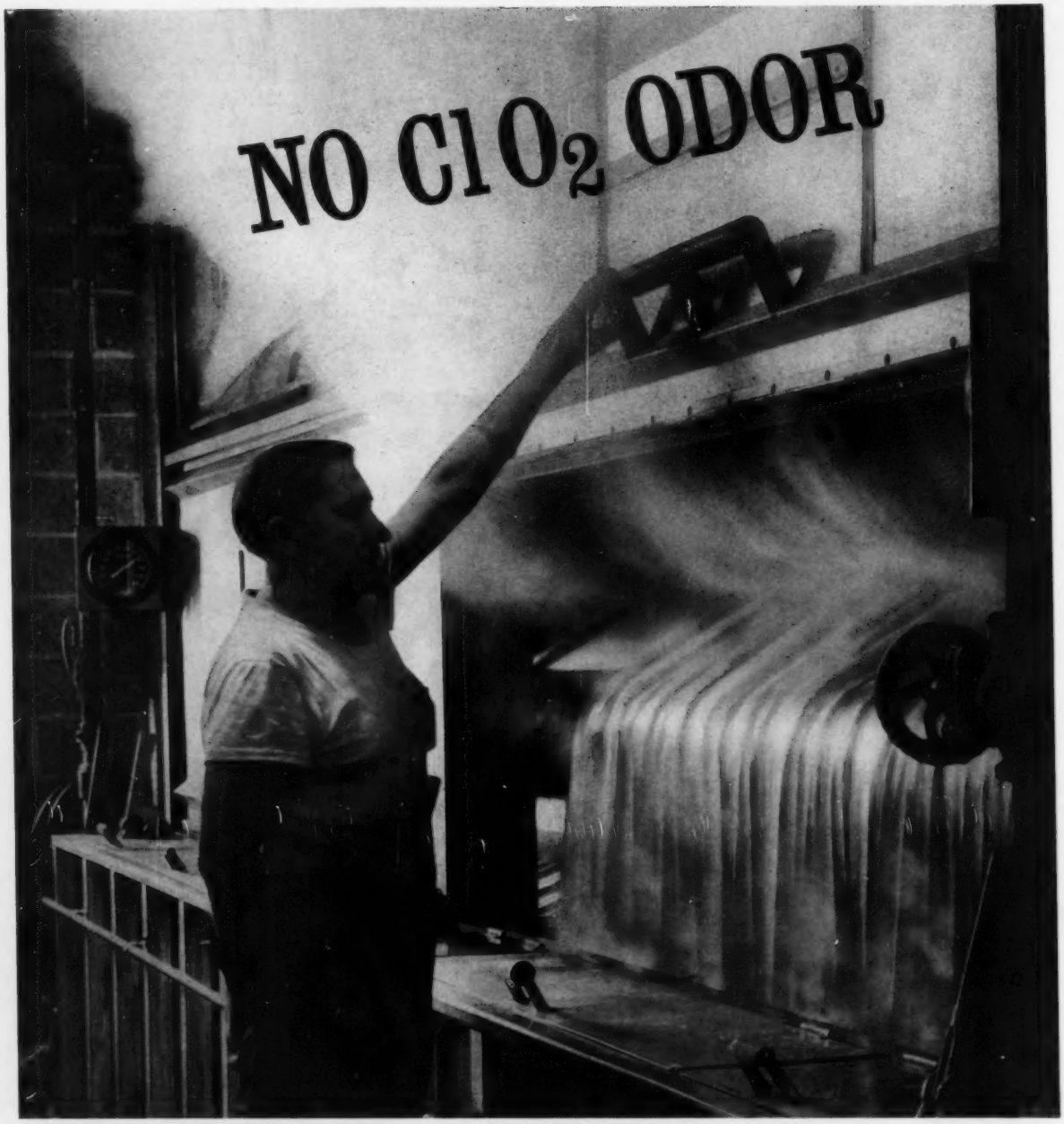

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VOLUME 50 October 30, 1961 NUMBER 22

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specially contributed

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aatcc proceedings

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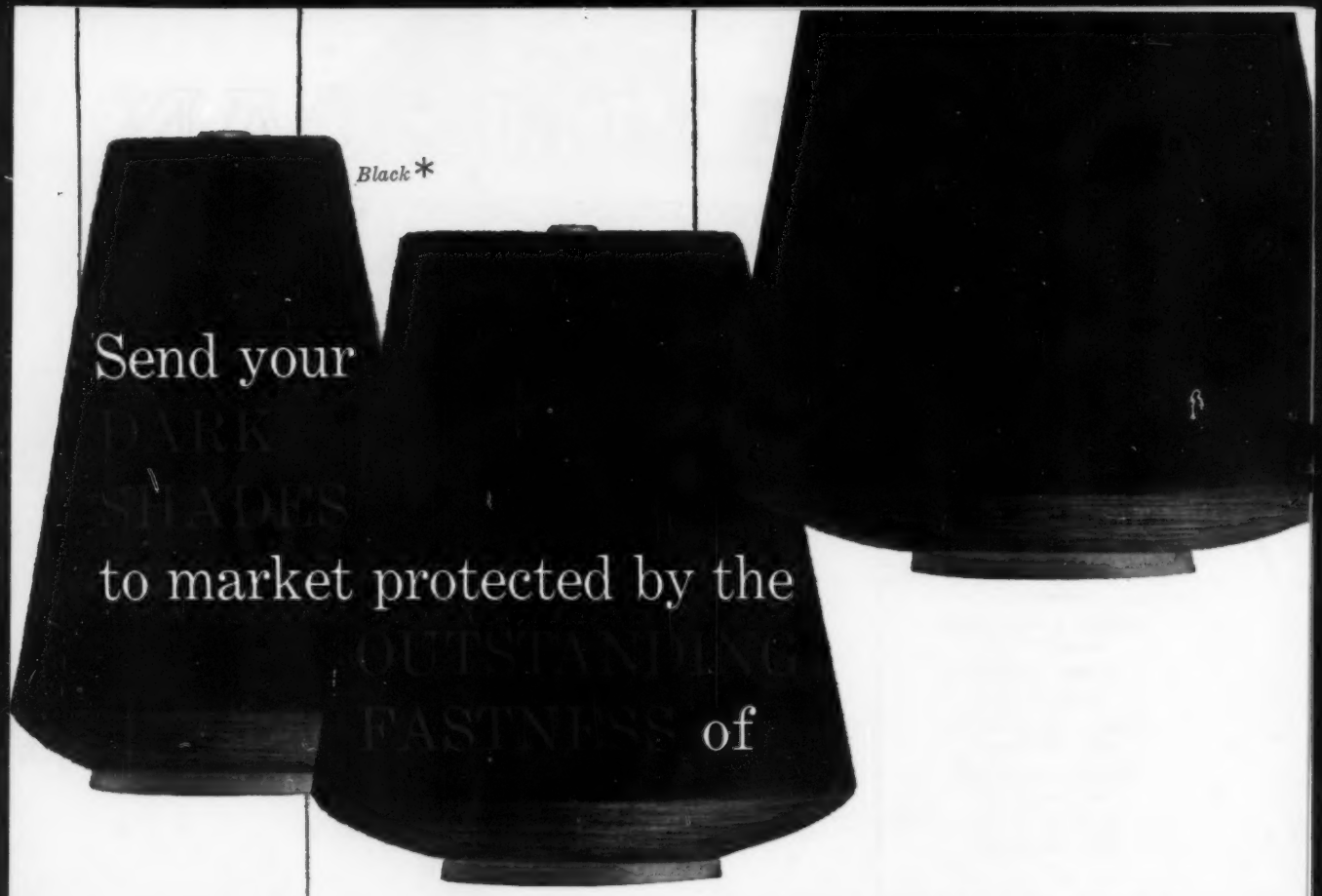

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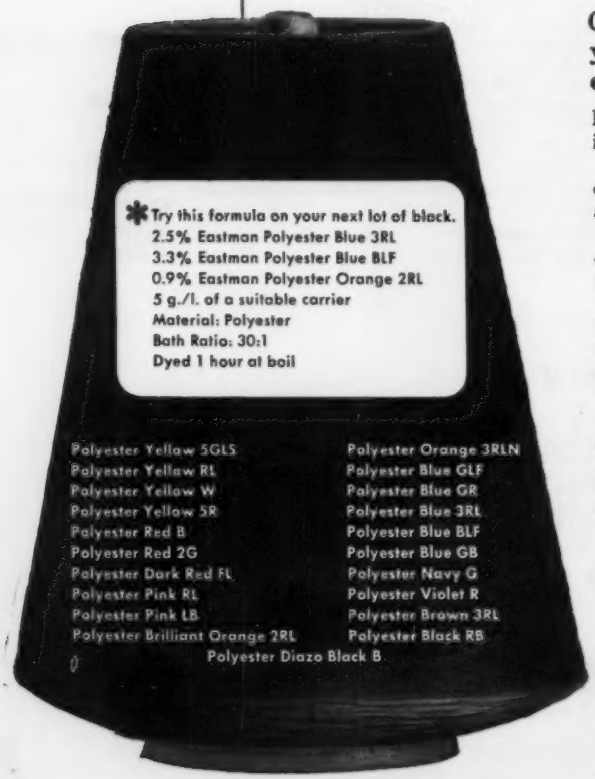

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ADR OPEN FORUM

(A page devoted to reader comments, general comments by the staff of *American Dyestuff Reporter*, and "letters to the editor". Names of those submitting material for this page will be withheld on request. Address letters to "Open Forum," American Dyestuff Reporter, 44 East 23rd St, New York 10, NY).

October 30, 1961

BUSINESS REACTION TO THE KENNEDY ECONOMIC PROGRAM

SOME of the interesting highlights of a study made by Opinion Research Corporation in July 1961 on the reaction of 150 top executives in manufacturing, utilities and finance to the economic program sponsored by the President were revealed last month by Hugh C Hoffman, ORC vice president, at a luncheon meeting of the Synthetic Organic Chemical Manufacturers Association.

Findings of the survey show that many corporations have the capital to expand; but are waiting for the President to come up with a constructive program to promote growth before they make major capital expenditures. When asked, "From what you have seen so far, how helpful do you expect the policies of the new administration will be in stimulating business growth and expansion?" Fifty-five per cent answered "not very helpful"—33% answered "fairly helpful"—11% had no opinion, and 1% answered "very helpful."

Some of the other points Mr Hoffman discussed can be summed up under these headings:

—From what they have seen to date, corporate executives are skeptical of Kennedy's proposals to promote growth.

—Executives express doubt that Administration leaders understand what motivates risk-taking.

—If Congress means to stimulate growth it will go to work on tax rates and depreciation.

—Administration tax proposals to date are viewed by executives as inadequate to achieve the growth objective.

—Executives are pessimistic about Administration backing for fundamental tax changes.

—Optimism that problems of depreciation will be dealt with is restrained.

—The prospect for further inflation is viewed with concern—executives do not regard inflation with complacency.

—Another unsettling influence in the business community is the uncertainty hanging over antitrust action—while believing in antitrust laws, corporate leaders doubt that current policies will foster the "mutual understanding and fruitful collaboration" that the President has called for.

—Executives in the electric utility industry are deeply disturbed about the expected course of the Administration on public power.

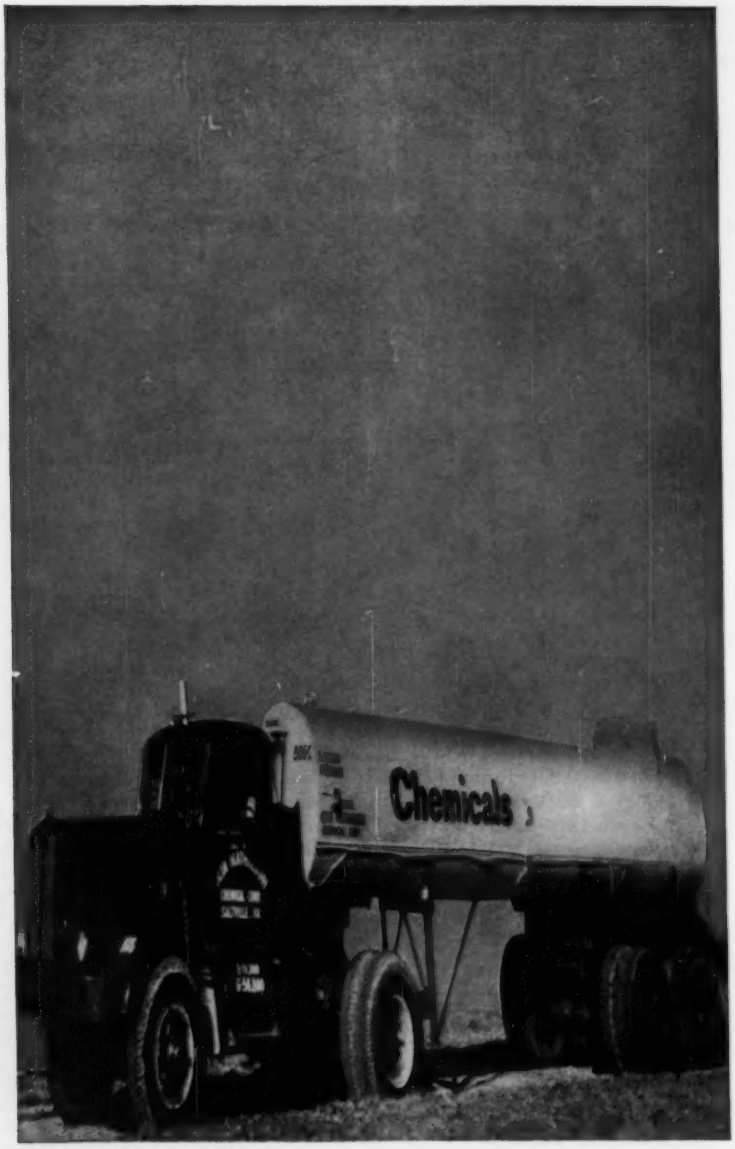
—Executives repeatedly underscore the importance of creating a climate of government that inspires confidence.

—A number of foreign countries furnish a better climate for investment, corporate heads believe. (It is sometimes overlooked that we are in a worldwide competition for capital and investment will flow where the climate is hospitable.)

—The secret of West Germany's amazing growth—inducements for private enterprise—might be given more attention. Many corporations have the capital to expand but the one factor that seems lacking to fuel the economic growth is confidence that the risk will be rewarded.

In a closing comment on the reaction of the business leaders polled, Mr Hoffman pointed out that business itself is not free from the charge that it has failed to meet its responsibilities to inform the public. A well-known commentator has expressed the criticism that even though business has the greatest reason for rallying public support to the cause of free enterprise it has failed really to explain its story.

Business cannot expect the American people to defend that which they do not understand. Business has to run for office too; it must have the confidence of the people if it wants legislation enacted or changed. If it wants to protect the American system of free enterprise, it too must campaign to make public opinion fully aware of its interests and needs.



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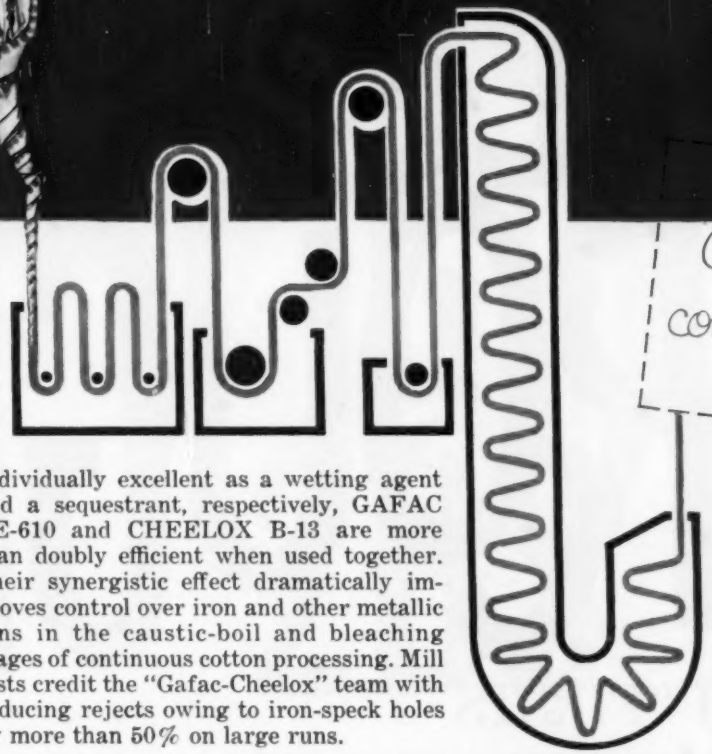

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SANDOFIX WE LIQUID can be applied in the dyebeck, in package machines, on the jig or on a pad. It is especially recommended for the following applications: In small percentages after dyeing and rinsing in the dyebeck, to prevent color migration while the goods are still wet. • On cotton or viscose carpets with rubber backing, to impart wet fastness. • On automotive upholstery fabrics, to pass specified migration tests. • On cotton tapes, belts and webbing, to prevent bleeding and migration. • On rayon lining material, to impart hot wet press and perspiration fastness. • On prints, to prevent bleeding into discharges, and to improve overall wet fastness properties. • On viscose/acetate white fabrics, to prevent bleeding of the direct colors into the acetate white portions. • In conjunction with UF resins to impart wash fastness to rayon dress goods. • In conjunction with reactant resins to increase wet fastness properties of direct dyed cotton goods. • On light and bright dyeings where minimum change of shade is desired.

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Specially Contributed

DYEING OF CUMULOFT CARPET NYLON

GEORGE WILKINSON
Application Research Dept
The Chemstrand Corp

INTRODUCTION

CUMULOFT* is a continuous filament textured nylon yarn developed specifically for use in the manufacture of carpets and rugs.

The texturing treatment combined with multilobular cross-section of the single filaments gives Cumuloft greater bulk, resilience and covering power. Freedom from pilling and shedding, excellent stain resistance and wear life continue to create wide consumer acceptance for carpets from this new yarn. In addition to having the most desirable end-use characteristics, Cumuloft nylon can be easily adapted to various manufacturing techniques. It can be woven or tufted and dyed either in piece or yarn (skein) form.

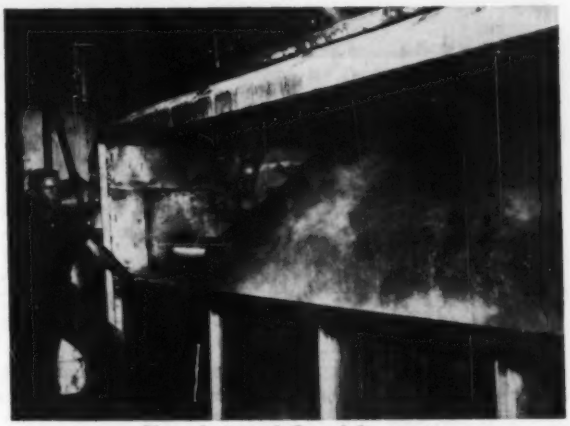
PIECE DYEING

EQUIPMENT———Any well-constructed carpet beck built for open-width dyeing can be used for dyeing Cumuloft carpets. The main requirement is that the interior surfaces of the machine be free of roughspots and imperfections which could snag and damage filaments. It is also important to be able to maintain uniform temperature across the width of the beck during the entire dyeing cycle, including the heating-up period. The machines need not be enclosed except where a constant draft could affect the temperature on one side of the beck. Slippage on the reel must be reduced to a minimum to prevent fuzziness on the back of the carpet. Covering of the reel with cotton duck is very effective in eliminating slippage. Adequate speed of the reel is also important and should be set roughly at a linear speed equivalent to the total length of the dyed rolls per minute. Gravity or steam-line dye feeds and attachments giving liquor circulation across the machine are helpful, but not essential, for successful dyeing.

The full bulk of the yarn develops only during the dyeing and to obtain the greatest cover the pile must not be compressed or restricted in any way, particularly in the early stages of dyeing. The carpet must, therefore, be run open-width, or lean pile, with poor coverage and rope marks, will result.

It is possible sometimes to run Cumuloft carpets in rope form, but this should be attempted only after a minimum of one hour open-width treatment at 200°F or above. This may be resorted to for correcting side-to-center unlevelness or in case of dyes which do not level well.

JUTE-BACKED CARPETS———The presence of jute backing creates special problems in dyeing of Cumuloft carpets. Jute contains a high percentage of water and alkali-soluble impurities. These create a double problem.



Piece-dyeing of Cumuloft carpet

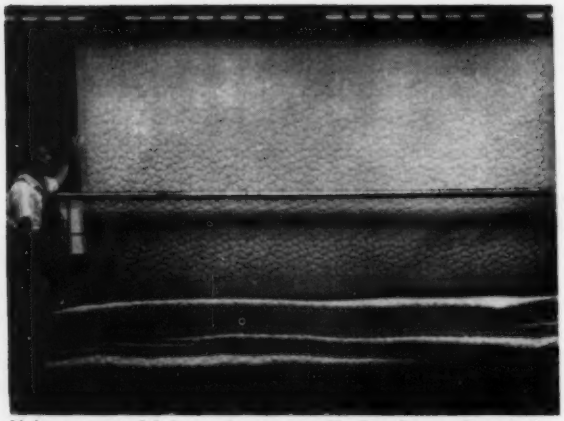
Firstly, the colored impurities can stain the nylon pile. The stain is often unlevel, may adversely affect the lightfastness of the dyeing and may produce a slight barré effect. It can be eliminated or greatly reduced by dyeing at high pH (high alkalinity). It can also be minimized by addition to the dyebath of anionic surfactants or by a previous scour. In the great majority of cases, the scour is not needed since other means for controlling jute stain can be used. If the scour becomes necessary, a combination of a nonionic or anionic detergent with sodium perborate gives very satisfactory results.

The second problem created by the presence of jute is in the dyebath pH control. It is very difficult to stabilize the dyebath at a pH higher than 9-9.5, which is necessary for optimum leveling conditions for certain disperse dyes. Even if quite high concentrations of alkali are used to set the dyebath at a pH of 10.5-11.0, the pH reverts to 9-9.5 after a short running period at 200°F. In practice this pH range becomes the highest which can be maintained during the dyeing, even though higher pH would sometimes be preferable.

DISPERSE DYES———Because of their excellent leveling power and ability to cover barré, disperse dyes are used almost exclusively in the piece dyeing of Cumuloft carpets. Since they can be readily applied at high pH, the jute stain is not severe and a prescour is not necessary.

For optimum results, the dyebath is set with 3 to 4% owf of trisodium phosphate and 1% of a nonionic surfactant (eg, Igepal CO 710 or Alkanol HSC). The goods are run at 100-125°F for 10 minutes, the dyestuff is

*Cumuloft is a trademark of The Chemstrand Corporation for its continuous filament textured nylon yarn.



Nylon carpet fabric as it comes off the dryer after dyeing

Final inspection of dyed Cumuloft carpet

added and, after a further 10 minutes at this temperature, the dyebath is heated to 205°F over a period of 30 minutes. After 45 minutes at 205°F, samples are cut from both sides and the center of the piece and color additions made if required. It is usually necessary to run for another 45 minutes before complete shade uniformity from side to center is obtained, whether or not additions of color are made. If, after a total time of 90 minutes at 205°F, the shade is not perfectly level, it is best to rope the carpet and run for further 45 minutes. The roping at this stage accelerates the leveling of the dye with very little danger of forming rope marks. The dyebath can be cooled before sampling or for additions of color or before dropping the dyebath, but this is not strictly necessary. Elaborate precautions during the heating of the dyebath or sampling before less than 45 minutes at the temperature are not required since neither the true color nor levelness of shade are achieved before that time.

Extensive mill experience and laboratory trials led to the adoption of three disperse dyes as the best practical combination for the majority of shades. These are: CI Disperse Yellow 3, CI Disperse Red 4, and CI Disperse Blue 3.

The lightfastness of a broad range of carpet shades dyed with the above combination is about 40 to 60 hours and should be assessed only by exposure to natural sunlight. The Fade-Ometer results are misleading because of the abnormal fade of the yellow component.

The wetfastness is adequate for piece-dyed, solid-shade styles. The gas-fading fastness is good under ordinary conditions, but a color change may occur if a wet carpet is exposed to gas fumes.

OTHER DYES——Dyes other than the disperse dyes have, at present, only limited application in the piece dyeing of Cumuloft carpets. In medium to heavy shades, selected acid dyes used in conjunction with certain surfactants are giving good results. Special nylon dyes (eg, the Nylomines) have also been used with success.

The chief limitation is the ability to cover barré, which is always present in the filament nylon. The use of surfactants does help to remedy this even in the case of the special nylon dyes. The side-to-side and side-to-center shading is also more difficult to control and, in selecting the dyes, their ability to migrate and transfer during the course of dyeing must be taken into account. The side-to-center shading is easier to overcome in rope dyeing than in open-width dyeing and, with formulas which do not transfer well, rope dyeing can be resorted to providing that the carpet has first been run one hour or longer open-width. This can best be accomplished by an open-width scour at 200°F. Since the acid and the special nylon dyes are applied at a lower pH than is used for disperse dyes, the scour is also necessary to avoid the jute stain.

Selected acid dyes can produce dyeings of higher fastness to light and wet treatment than the disperse dyes, but the latter are much more widely used in piece dyeing owing to their ease of application.

SKEIN DYEING

If the styling requires a multicolored effect, the Cumuloft yarn is dyed in skein form. The moresque or tweed effect is obtained by skein dyeing the 1230-denier yarn separately and then plying together three ends of different colors.

Cumuloft skeins can be dyed either in the skein machines of the Hussong type or in pack form in the raw-stock-dyeing kettles. For pack dyeing, the skeins must be prebulked either by immersion in hot water (15 minutes at 190°F) or by steaming (10 minutes in saturated steam at 212°F). The yarn must not be under tension or restricted in any way during the bulking.

The skeins shrink 20-25% during the bulking operation. If the yarn is dyed on sticks in the Hussong machine, the prebulking is not necessary to develop the loft of the yarn, but is sometimes helpful in getting level dyeings. In this case, the yarn is lowered into hot water (200°F or more) and allowed to steep for fifteen minutes without circulation. Steam bulking can be best accomplished by lowering the loaded carrier and boiling a small amount of water in the bottom of the machine. The prebulking is particularly recommended if the machines are not equipped with bottom sticks. It is also possible to pack dye Cumuloft in Hussong machines, but the load increase over dyeing on the poles is only about 30-40% which is hardly enough to justify the extra handling involved in prebulking and reloading of the machine for pack dyeing.

Since the skein-dyed yarn is almost invariably used for multicolored effects, the disperse colors are limited to very light shades. Medium and heavy shades must be dyed with selected acid or special nylon dyes which often require an aftertreatment with tannic acid and tartar emetic to achieve adequate wetfastness.

The dyeing methods are similar to those used in

piece dyeing, but the dyeing is made simpler by the absence of jute.

With disperse dyes, a prescour is not necessary and the large amounts of alkali are not needed to maintain the desired pH. One-half to one percent ammonia is used to set the dyebath, together with a similar amount of a nonionic surfactant.

The dye is added at 120°F, the dyebath brought to 205°F in 45 minutes and maintained at this temperature for a further 45 minutes before the lot is sampled for shade. With correct machine loading and adequate liquor circulation this should be sufficient to obtain a uniform shade throughout the dyelot. If color additions are necessary a further 45 minutes at 205°F is required. When the correct shade is obtained, the yarn is rinsed and unloaded. It is best not to add any finish because several of the compounds usually recommended can increase soiling of the carpet. If this finish is required to facilitate winding its soilage-promoting characteristics should be checked.

Selected acid dyes which give sufficient barré coverage in piece dyeing can be also applied to Cumuloft skeins in the Hussong-type machine. They often vary in their ability to migrate and level out at the boil so special care must be taken to feed them on slowly and uniformly. The best means of controlling the rate of exhaust is by buffering the bath to a pH which would allow an exhaust of about 50% of the dye present by the time the temperature of dyeing is reached.

If pack dyeing, especially in the machines where the flow is weak and not easy to control, it is best to use the special nylon dyes, such as the Nylomines, which draw uniformly and migrate well at the boil.

SUMMARY

Cumuloft can be dyed to commercially acceptable standards with disperse colors. Dyeing with selected acid and special nylon dyes is practicable within certain limits; various surfactant systems recommended by the dyestuff companies are frequently very helpful. No satisfactory method has as yet been developed for applying the neutral metallized dyes, the use of which could result in improved lightfastness of dyed carpets.

Continued efforts are being made by the fiber manufacturer and the dyestuff companies, to produce a good dyeing technique for these dyes which, if successful, would considerably broaden the range of the new yarn.

ADR ABSTRACTS

Metallic Threads by Lamination

Anon, *Ciba Rev* 1961/3, p 17-21

Metallic yarns used in former times consisted either of finely drawn metal wire or thin ribbons of tinsel (rolled metal sheet), or of spun-metal threads, ie, textile yarns wrapped round with fine wire or tinsel. Unlike these, the flat metallic threads of today are *laminates*.

The base material usually is a thin aluminum foil no thicker, perhaps, than 0.01 mm. More recently, a clear plastic film, eg, polyester, vaporized with aluminum in high vacuum or otherwise metallized, has been substituted. The deposition of extremely fine metal particles results in high glitter of the surface.

The aluminum foil or metallized film is sandwiched between two transparent films and laminated by the use of special adhesives. The outside films may be clear or translucent; in addition, they may be colorless or colored.

Regenerated cellulose (eg, Cellophane) was originally used for the transparent films, but later was replaced by cellulose acetate or triacetate. Today, polyester films are also used; they are considerably tougher and stronger.

The metallic yarns proper are obtained by slitting the rolls of bonded sheet into wide ribbons which, in a second operation, are reduced to a final width ranging between 1.59 mm and as little as 0.21 mm. The width in greatest demand is 0.40 mm.

As compared with wire or tinsel threads and spun-metal yarns, laminated metallics have the following advantages: they are easier to process, non-tarnishing (no dulling through oxidation or corrosion), not harsh to the touch, and odorless.

Modern metallic yarns find use as effect threads in woven fabrics, especially dress goods and furnishings, brocades, and evening gowns, for smallwares of all kinds, belts, buckles, and trimmings, and also for plaited goods and in the millinery industry.

A table of the 19 principal metallic threads now being produced, listing their trade names, composition, widths, and manufacturers, is appended.

Textiles from "Pulp"?

Abbenheim, P, *Man-made Textiles* 37, 32-5, August 1961

Roughly speaking, three methods have been developed for making "nonwoven" fabrics: bonding (with use of adhesives), sewing (using the Arachne and Malimo machines), and paper-making (a modification of the paper-making process). This article is concerned mainly with the last-mentioned.

In the US, two new generic names have been coined by Du Pont for the paper-making system. The fibers used for bonding are known as "fibrids", while the materials made from them are called "textryls".

According to Du Pont, the synthetic fibers now provide the paper industry with a new group of raw materials for diversification. By using fibrids as binders it is possible to handle these fibers commercially on paper-making machinery.

The fibrid is a fibrous synthetic polymer particle with a morphology somewhat similar to beaten wood pulp. Almost any synthetic polymer can be used for fibrid production.

At present Du Pont are making three fibrids on an experimental basis. These are:

101 fibrid—a polyamide intended mainly for use with ¼-inch nylon paper-making staple,

201 fibrid—a polyester for use with ¼-inch Dacron polyester paper-making staple, and

302 fibrid—an acrylic for use with ¼-inch Orlon acrylic paper-making staple.

Du Pont have developed these three special staples which are not simply very short length-type staples. They have been specially designed for use on paper-making machinery.

After the textryl is made on the paper machine, to obtain its full strength, it is subjected to heat in order to fuse the fibrid binders.

In a somewhat different direction is RD-101 of American Viscose Corp. Here a rayon fiber is being developed. RD-101 is reputed to be the first 100 percent man-made fiber which can be used to make paper without the need for adding pulps, fillers or binding agents, other than water, to form a slurry.

The RD-101 fiber is a multi-cellular viscose rayon, normally with a length of ¼-inch. The fibers are non-thermoplastic, and when formed into a wet-laid web and dried they will firmly bond themselves together and lock in place with other fibers with which they are mixed, or among themselves if used 100 percent.

Experimentally RD-101 has been produced in a wide range of deniers and fiber lengths with low, as well as high, bonding strengths. The low-bonding types give "soft, opaque sheets"; the high-bonding types give "a dense, strong, crisp, scuff-resistant sheet".

The application of RD-101 to paper-making machines is described in detail.

As to possible outlets for these "textryls", it is predicted that there should be a good market in the interlining trade and also as book-binding materials. The American Viscose Corp suggest a variety of further applications for RD-101, from filters to wall-coverings. Uses proposed by Du Pont for the synthetic textryls include upholstery fabrics and "washable folding money that is hard to counterfeit".

●

How Reactive Dyes Work; Practical Implications of Dyeing Theory

Vickerstaff, T, *Dyer* 126, 166-8, Aug 11, 1961

Reactive dyes for cellulose must be capable of reacting with hydroxyl groups in the fiber, and it is obvious that side reactions with water in the aqueous dyebath are almost unavoidable. During the past few years more attention has been paid, in the study of dyeing with reactive dyes, to the actual chemical reactions which take place, and the most significant recent advance has been the realization that reaction occurs only with ionized hydroxyl groups in both cellulose and water.

The factors which determine the rate of the reactions of these dyes with cellulose and water are discussed by the author, who points out that as there can be no leveling with reactive dyes on cellulose, once the reaction is complete, further extension of the dyeing time is valueless.

There are significant differences between the reactivity of individual dyes in the two groups, Procion and Procion H, the most reactive being roughly ten times more active than the least reactive. The average reaction constant for the Procion dyes is about 50 times greater than that for the Procion H dyes.

To increase the rate of reaction of the Procion H dyes, the dyeing temperature may be increased from 20° to 70°C, which increases the rate 50 times. Also, the rate of reaction is changed by changing the pH of the dyebath to vary the concentration of cellulose ions in the fiber. If the pH is raised by one pH unit, the concentration of cellulose ions will increase tenfold. Above pH 11, however, the exhaustion of the dyebath falls off rapidly.

The author discusses the control of dyeing conditions to give the best possible exhaustion of the dyebath and maximum reaction with cellulose and not with water.

In the case of a low yield, the first step is to determine whether this arises from excessive hydrolysis in solution or from the presence of unused but still reactive dye at the end of the process. If the latter, the dyeing time should be prolonged, or, in the case of continuous processes, the heat treatment should be repeated before washing off.

If, however, no unreacted dye remains in the bath and the yield is poor, it may be improved by using dyes of higher affinity, the use of a lower liquor ratio, an increase in the electrolyte concentration, or possibly a reduction in alkalinity.

Suggestions for correcting unevenness in continuous dyeing include adding a thickener to the padding solution to inhibit migration, using dyes of low affinity, and raising the temperature of the padding liquor.

●

Wool Fabric Stabilization by Interfacial Polymerization. 1. Polyamides

Whitfield, R E, Miller, L A and Wasley, W L, *Textile Research J* 31, 704-12, August, 1961

A new technique is presented for making wool fabrics shrink-resistant. The technique consists in bringing a solution of a diacid chloride (eg, sebacoyl chloride), in an inert, water-immiscible organic solvent, into contact with an aqueous solution of a diamine (eg, 1.6-hexamethylene diamine); polymer is formed almost instantaneously at or near the interface of the two liquid phases.

Weighed and conditioned wool flannel swatches are immersed for varying lengths of time up to 60 seconds in an aqueous solution of the diamine, then passed through squeeze rolls to remove excess solution. Subsequently the cloth is immersed in a nonaqueous solution of the diacid chloride for varying lengths of time up to 60 seconds, and again passed through squeeze rolls to remove excess solution. Formation of a polyamide resin, eg, poly(hexamethylene sebacamide) takes place at the fiber surfaces. The fabric is finally rinsed with water and dried. No curing of the resin is required.

Solvents used for the acid chloride include carbon tetrachloride, toluene, methyl chloroform and Stoddard solvent.

Less than 5% resin on the fabric is required for dimensional stability in laundering. The wool fabrics treated are essentially unchanged in hand, flexural rigidity, break strength, percent elongation, and chemical resistance; they are improved in wrinkle recovery and smoothness after tumble drying.

The technique described above gives promise of being readily adaptable to continuous operation. It has been found suitable for a wide variety of wool fabrics, and merits further development and extension to other polymer systems, as well as to other textiles.

Twenty-seven references to the literature are cited.

●

Polypropylene Fibers

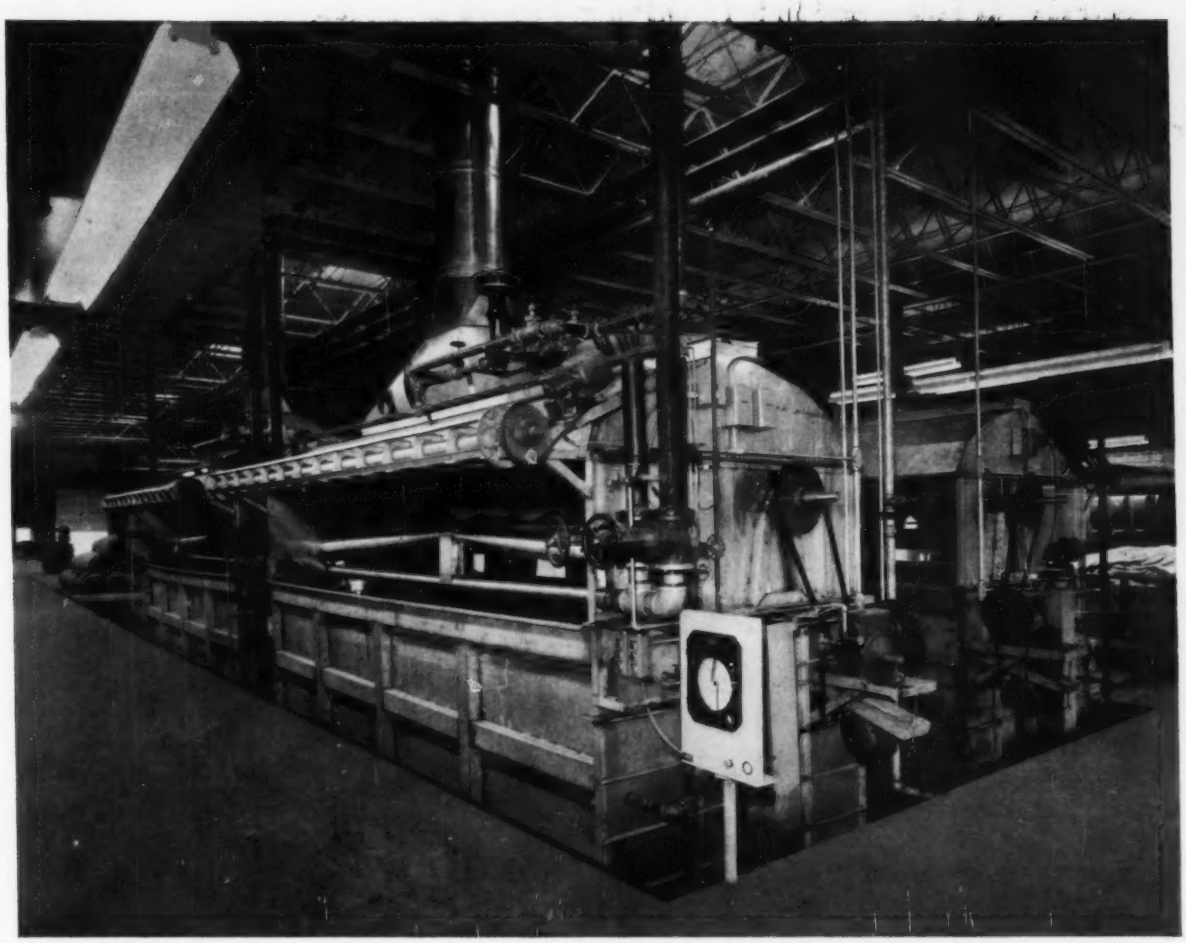
Thompson, A B, *Man-made Textiles* 38, 35-8, July 1961

Olefines, particularly ethylene and propylene, are attractive raw materials for polymers because of their availability and price. The only polymers obtainable from polypropylene at first were viscous oils or soft amorphous solids, unsuitable for fiber-making. Within recent years, however, a polypropylene of sufficient steric regularity to crystallize has been produced in Italy. Fibers made from it have a m p of about 165°C, and are now being produced on a large scale in the U S and Britain.

Polypropylene fibers are of low density, high strength, high durability and high enough softening point for many uses. They are expected to fall in the price range between the polyamides, polyesters and finer wools on the one hand, and the natural and regenerated cellulosic fibers on the other.

So far the most developed markets are in the U S for monofilaments for ropes and outdoor upholstery. Various other industrial and domestic outlets for finer filaments and staple fiber, both alone and in blends,

(*continued on page 58*)



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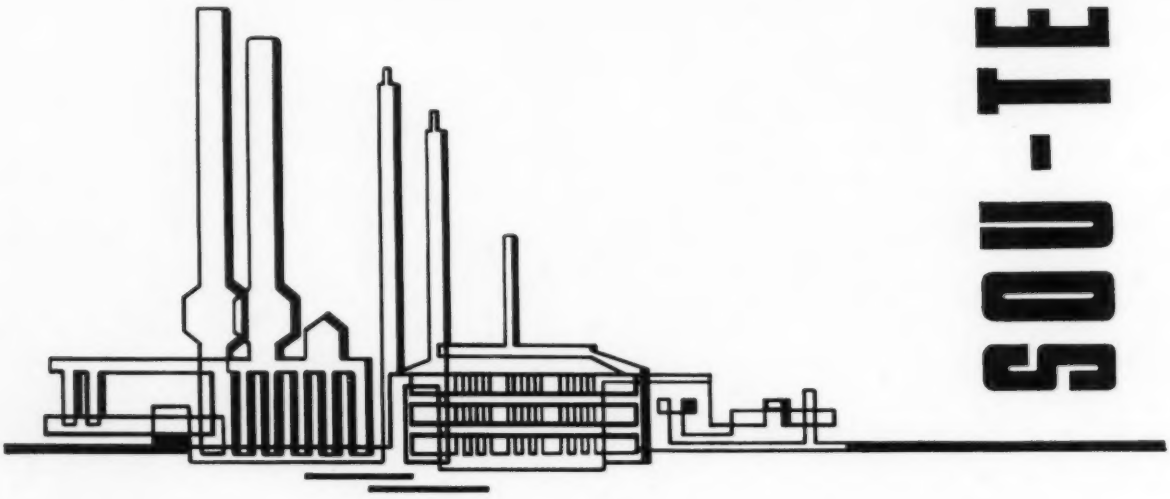

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1961 Olney Medalists' Address———

A CHALLENGE TO SCIENTIFIC INVESTIGATION IN THE TEXTILE INDUSTRY: TEN AREAS OF OPPORTUNITY*

FRED FORTESS
Assistant Director
Applications and Product Development Department
Celanese Fibers Company
A Division of Celanese Corporation of America

INTRODUCTION

THE occasion of the Olney Award address provides the recipient with a special privilege and an opportunity almost as rewarding as the medal itself. The Medalist is free to select any subject matter, ranging from a detailed description of specific technical problems in the textile industry to taking a broad philosophical view of the physical sciences as applied to polymers and fibers. We propose to take advantage of this privilege by exploring the textile industry for those areas where research and development activities are clearly recognized as essential.

Since this audience is composed of members of the AATCC, it may serve a useful purpose at the very beginning to recognize the diversity of interests and skills represented in our Association. Our national headquarters recently made a preliminary analysis of its membership. This is summarized in Table I. However, this tabulation does not define the nature of the specific activities of each member, or which of the many phases of the textile industry is represented in any given category. Thus, a research chemist may be carrying out polymer research for a *synthetic fiber manufacturer,* or an organic synthesis for a *chemical company* supplying sizing or finishing materials; or he may be investigating dyestuff synthesis or the mechanism of dyeing for a *dye manufacturer;* or he may be studying the chemical and physical properties of fibers and fabrics in *government, private research,* or *academic laboratories;* or he may be evaluating the behavior of fibers, surface-active agents, dyes and chemical finishes for a *textile fabric manufacturer* primarily concerned with supporting the technology and efficiency of his dyehouse.

It might serve a useful purpose if we more clearly describe the composition of the textile industry, and those phases of supporting industries directly servicing or supplying it. One possible way of schematically showing this relationship is described in Figure 1.

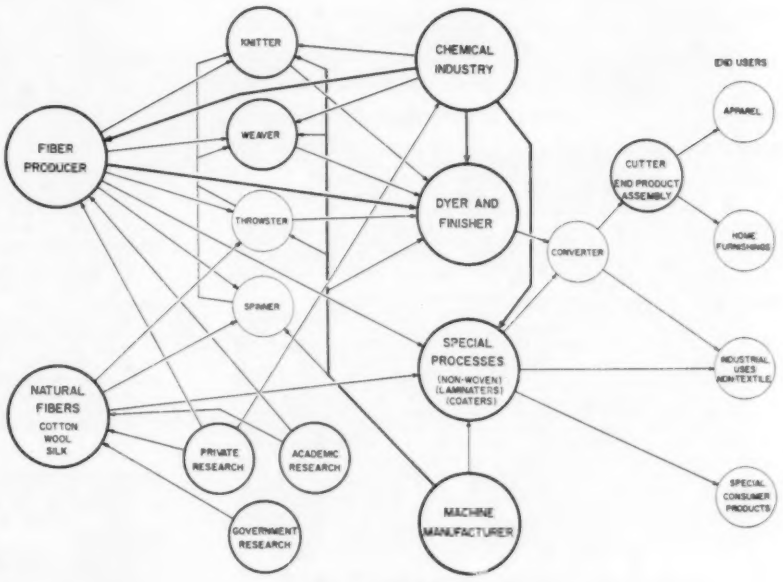


Figure 1
Areas requiring research and development in the textile industry

Logically the starting point of what may be called a total picture of the textile industry would be the basic-raw-materials suppliers, namely the man-made-fiber producers and those agencies which make available the natural fibers—cotton, wool and silk.

TABLE I
Functional occupations of AATCC membership

Research & development chemists	1416
Dyers and finishers	1314
Research directors and technical managers	315
Academic researchers and educators	129
Technical service and sales personnel	1420
Laboratory technicians and assistants	118
General managers and superintendents	429
Quality-control personnel	46
Corporate officers	811
Consultants	65
Miscellaneous	631

At the other end of the flow of textile materials, specifically the one closest to the ultimate consumer, we would find the cutter and the assembler of special products. In this description we are not including the retail distributor of textile materials as a part of the textile industry because, although he has excellent testing and evaluating laboratory facilities and many of his employees are members of the AATCC, their primary function does not involve the physical sciences directly in the research and development of new and more useful textile materials. Supporting these two primary activities, eg, the supplier of raw textile materials and the assembler who produces finished products, are two major industries which are normally considered outside of the textile industry but which look upon the textile industry as an important market for their products. These are the chemical industry and the machinery

*Presented before the AATCC National Convention, Buffalo, NY, September 28, 1961.

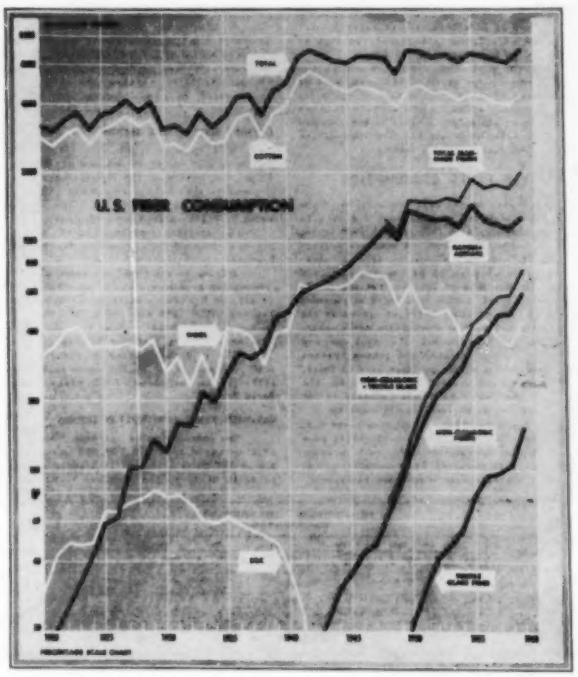


Figure 2

manufacturing industry. The center of gravity of the textile industry is, however, the spinner, throwster, weaver, and knitter, and most important of all to the AATCC, the dyer and finisher.

Figure 1 reminds us of the complex interrelationship and interdependence of the various phases of the textile industry. Our primary objective in this paper is to explore those areas in this industry where research and development activities are currently being focused and which, in the future, may require even greater emphasis.

A RESEARCH DIRECTOR'S VIEW OF THE TEXTILE INDUSTRY

To help us with this objective, we will create a hypothetical director of research and through his eyes try to see the total textile industry as if it were an integrated, vertical organization subject to a planned and coordinated research and development effort.

Let us assume that, with the aid of market research, sales and reports such as that produced by Irene L Blunt, "Basic Research Related to New Uses for Textiles" (*1*), for the U S Department of Commerce, our research director draws up Figure 1 in such a manner as to emphasize areas now employing a considerable research and development effort. This he has done by making the circles larger and heavier for those segments of the industry such as fiber producer, natural fibers, chemical industry, dyer and finisher, special processes, machine manufacturer. In areas of second importance from the point of view of their current efforts, he has placed private, academic and government research laboratories, the knitter and the weaver. He has looked at the needle trades industry, which we have identified as cutter, with its 1,200,000 employees, and has given this segment a heavy circle, more from the point of view of what research and development efforts may have to be carried out in the future rather than from that of current activities in improving the technology and reducing costs in this vital segment of the textile industry.

RESEARCH AND DEVELOPMENT SUPPORTING TEXTILE-FIBER PRODUCERS

The first major problem with which our research director will be confronted is the fact that the textile industry already has available more than a score of natural and manmade fibers of widely different physical and chemical properties. About these he can ask several questions:

1) Do the existing fibers satisfy all of the basic end-use needs of the ultimate consumer in terms of both price and performance?
2) Is there sufficient technical information already available concerning the individual fibers, the processability of these fibers either alone or in blends or combinations with other fibers; the wet processing, coloration, mechanical and chemical treatment of these fibers in the dyehouse; and are there effective tools for the assessment and evaluation of the performance characteristics of the end products produced from these fibers?
3) Are there now available or at the exploratory research level, new fiber-forming polymers which in potential performance and price can replace any important quantity of existing fibers?

The analyses of these questions will require a consideration of the social and economic background in which revolutionary changes have created an ever-increasing leisure-time interest in "ease-of-care" performance. Will he, therefore, give emphasis to the development of new fiber-forming polymers which are inherently more "ease of care", or will he consider the vast existing production capacity for the natural fibers—cotton and wool; and the synthetic fibers—rayon, acetate, nylon and the acrylics, and emphasize research which will make possible more extensive exploitation of these already available fibers?

To obtain a proper perspective on the fiber raw material supply in the USA, he will probably want to examine carefully the curves shown in Figure 2 taken from *Textile Organon* (*2*). He will be impressed by several significant trends. Most obvious of all will be that cotton has maintained its position as the major textile raw material at close to the five-billion-pound level. Closer examination of the end uses for this natural fiber will reveal that, despite the fact that many important industrial applications, such as tire cord, have been lost to cotton, this loss has been more than recovered because new and improved mechanical and chemical treatments have resulted in increased use of this fiber in apparel and consumer utility applications. He would also become aware of the fact that

at government laboratories such as the Southern Utilization Research & Development Division of the U S Department of Agriculture in New Orleans, La, and at private institutions such as the Textile Research Institute at Princeton, NJ, the investigation of cotton fiber morphology and its response to various mechanical and chemical modifications are providing new avenues for the more effective exploitation of the oldest of our textile raw materials.

Our research director might display some concern with the erratic behavior of the wool fiber in the total textile market, and might seriously ask himself the question "Will wool gradually lose its important position as a textile fiber?" If he is an optimist and will take a page from the cotton success story, he might ask himself the question "Can the wool fiber remain a vital factor in textile applications through further understanding of its basic chemical and mechanical properties, if new and improved techniques for the elimination of any shortcomings could be made available by an effective research and development program?" Since we can assume that he is objective, and will have no vested interest in any one of the many textile fibers available, he may even ask the question "How can we maintain the most effective exploitation of the wool fiber by better engineering fabric design using blends with those synthetic fibers which supplement and enhance wool's natural desirable properties?"

In Figure 2 he will also discover the fact that regenerated cellulose fibers and ester derivatives of cellulose continue to maintain their yearly production level well above one billion pounds of fiber. Because these fibers are relatively inexpensive, and because the productive capacity for these fibers is already in existence, he may address himself to the question "How can these fibers be modified to overcome their shortcomings and remain competitive in price and performance with the natural fibers on the one hand and the newer synthetic fibers on the other hand?"

He will, however, be most impressed with the sharp and continued growth in the noncellulosic, wholly synthetic fibers since 1943. He will have considerable pressure put upon him from the chemical industry, particularly if this chemical industry is also producing fibers, to increase the emphasis on both the support of ex-

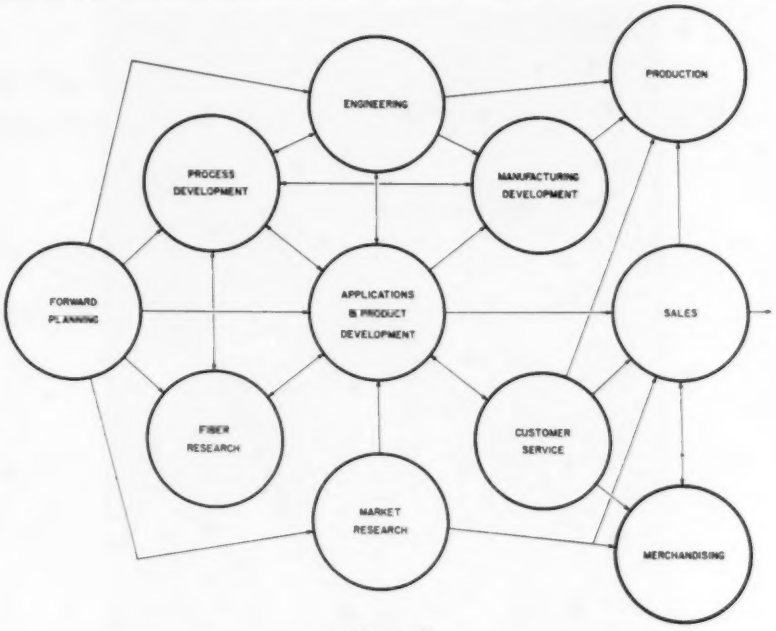


Figure 3
Interrelation of the R&D functions in new fiber product development

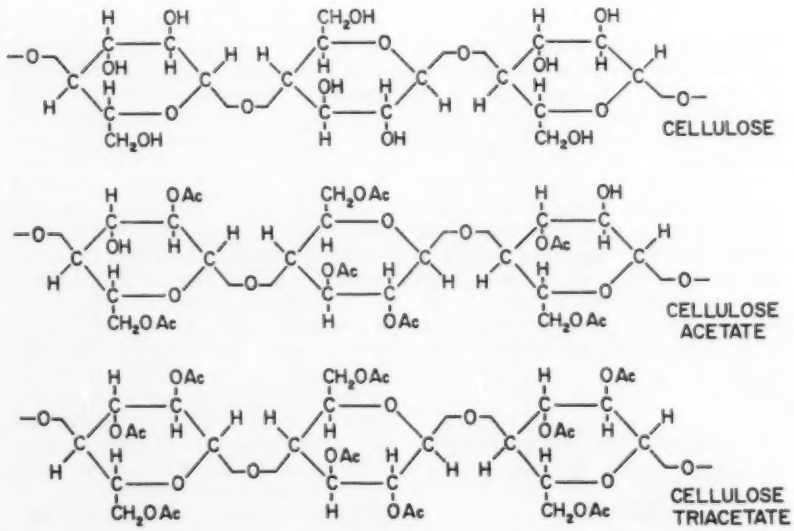


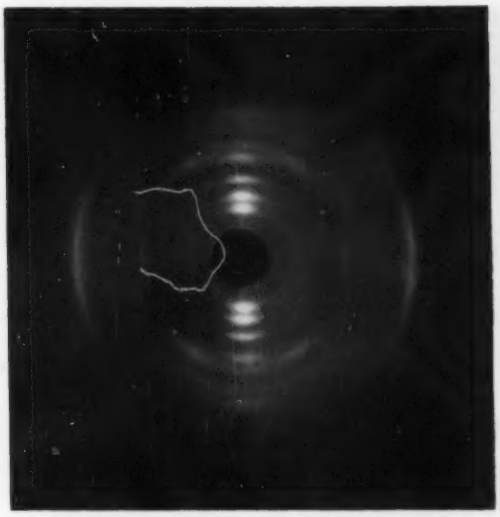
Figure 4
Comparison of structures for cellulose, cellulose acetate and cellulose triacetate

TABLE II

Effect of heat treatment on fabric properties

Physical changes	*Improvements in "ease-of-care" properties*
1) Increases size and or perfection of crystallites	1) Increases softening and melting point, improving ironing and glazing resistance 2) Decreases moisture regain and increases drying rate 3) Reduces swelling and shrinkage 4) Reduces dyeing rate and staining properties
2) Relaxes stress in fibers and yarns introduced in textile processing	1) Improves dimensional stability 2) Improves wrinkle performance
3) Increases diffusion of dye from periphery into fiber	1) Improves washfastness 2) Improves gas fading 3) Improves "O"-fading

X-ray diffraction pattern of nonheat-treated triacetate



X-ray diffraction pattern of heat-treated triacetate (240°—30 seconds)

Figure 5

isting wholly synthetic fibers and the development of new fiber-forming polymers for textile applications, since these fibers still represent only a minor portion of the total fiber consumption in the USA.

Our research director, while he is still concerned with the problems of the primary fiber producer or supplier of natural fibers, will find himself confronted not only with research and development areas related to polymers, fiber-forming processes and the assessment of the performance characteristics of these fibers, but also with problems which will flow back to the producer from many of the other segments of the textile industry utilizing these fibers. He will, therefore, have to construct another chart similar to Figure 1 solely for the fiber producer. In Figure 3 we see one of the many possible interrelationships through which new fibers are developed, produced and sold to the manufacturing sector of the textile industry. These will in turn communicate back through sales, merchandising and customer service problems from the market, which require adaptation and modification of the fibers at the research and development levels. He can be sure that the commercial dyehouse will be a major source of problems resulting from the increased utilization of the established fibers in new applications, or from those requiring improved performance characteristics. The dyer and finisher will also create a demand for new information which will make possible the introduction of new fibers into the textile industry. Our research director may be appraised of the experience with cellulose triacetate as an example of the research and development effort required to support this relatively new and commercially important fiber in the textile industry during the past six years.

RESEARCH AND DEVELOPMENT SUPPORT OF CELLULOSE TRIACETATE IN THE TEXTILE INDUSTRY

Our research director will learn that the history of cellulose triacetate is rather unique in that it was first commercially produced by the Lustron Company in the USA in 1914 and failed. Many factors led to its failure, not the least of which was that it came into existence long before commercial dyeing and stabilization technology were available to support it in the commercial dyehouse. The increased consumer interest during the 40s and the 50s for fibers with "ease-of-care" properties placed a major emphasis on the development of new textile fibers which would satisfy these demands. By 1950 the commercial dyehouse had built up 20 years of experience with the disperse dyes developed for the commercially important but relatively easy-dyeing secondary acetate and for nylon, and was beginning to have experience with really difficult-to-dye fibers like Orlon 81 and the polyester fibers produced from polyethylene terephthalate. However, three major factors can account for the success of the triacetate reintroduced in 1954. They are:

1) Triacetate could be produced relatively economically on facilities already available for producing the secondary acetate fiber.
2) New information became available on the structure of the triacetate fiber and its ability to be converted into fabrics of "ease-of-care" properties by optimum heat treatment and selection of dyes in the commercial dyehouse.
3) An effective combination of end-use fabric design for economy, performance, and styling versatility, backed up by an identification program guaranteed to provide fabrics meeting minimum performance requirements.

The research and development effort which supported this commercial success can be related to an understanding of the chemical differences between cellulose, cellulose acetate, and cellulose triacetate, illustrated in Figure 4. A detailed exploration of the changes in physical characteristics as related to performance characteristics resulting from heat treatment is illustrated in Table II. Such basic investigations of the change in internal structure resulting in crystallization and significant changes in thermal properties as measured by X-ray pattern is shown in Figure 5.

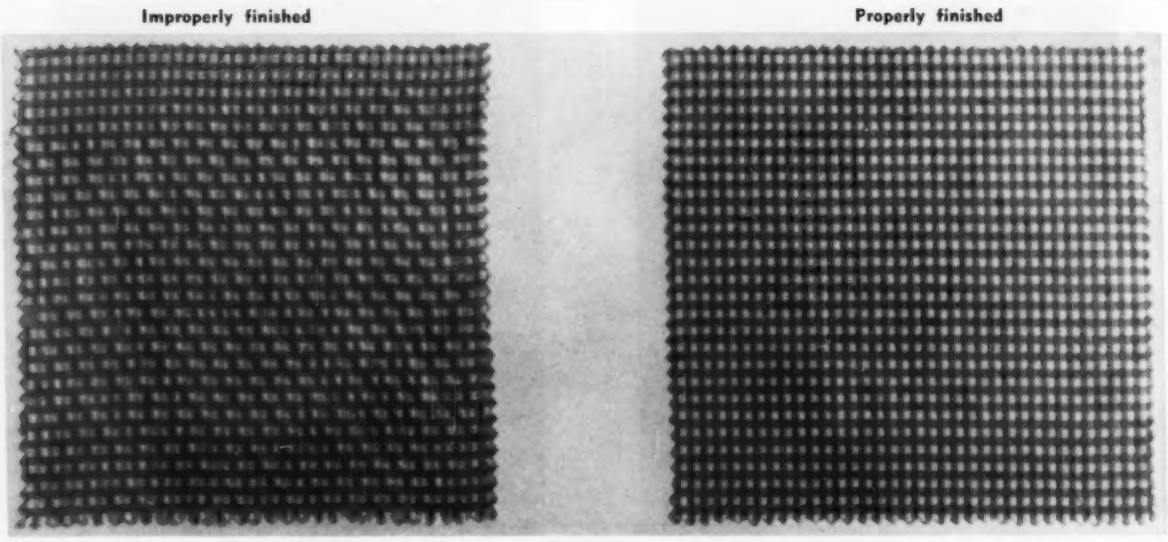


Figure 6
Optimum finishing to produce washable Arnel/cotton checkster-resistant to puckering

With this kind of supporting research it was possible to impart to properly designed fabrics containing the triacetate fiber properties related to "ease-of-care" performance listed in Table III. In the final analysis, detailed, practical procedures which could be translated into commercial dyehouses had to be made available, and several of these are listed in Table IV.

Our research director will be confronted with an example in which all of this technology had to be brought to bear on a single important problem, eg, the elimination of puckering on washing in a 6 × 6 check containing triacetate and cotton. In order to prevent differential shrinkage between these fibers, the

TABLE III
Properties related to "ease-of-care" performance

Dimensional stability
Wrinkle resistance (dry and wet recovery from deformation)
Crease retention and pleatability
Ease of laundering and drying
Washable colorfastness (so that a minimum of precautions need be exercised)
Ease of ironing or touching up
Retention and appearance after washing and drying
Retention of appearance and shape in wearing
Retention of hand and drape

TABLE IV
Factors in dyeing and finishing which affect "ease-of-care" performance

1) Optimum conditions of heat treatment
2) Selection of dyes for balanced colorfastness
3) Control of dimensions in drying and curing
4) Control of tensions in wet processing
5) Selection of chemical finishes for all fibers in the fabric
6) Durable finishes for retention of hand and drape

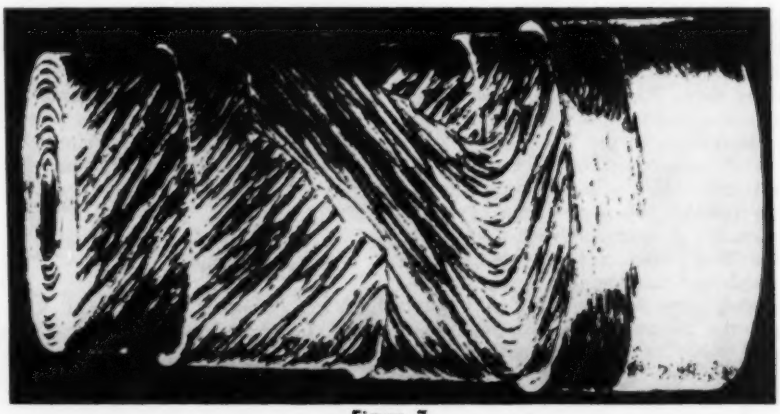


Figure 7
Schematic drawing of structure of cotton fiber after Anderson and Kerr (1938)

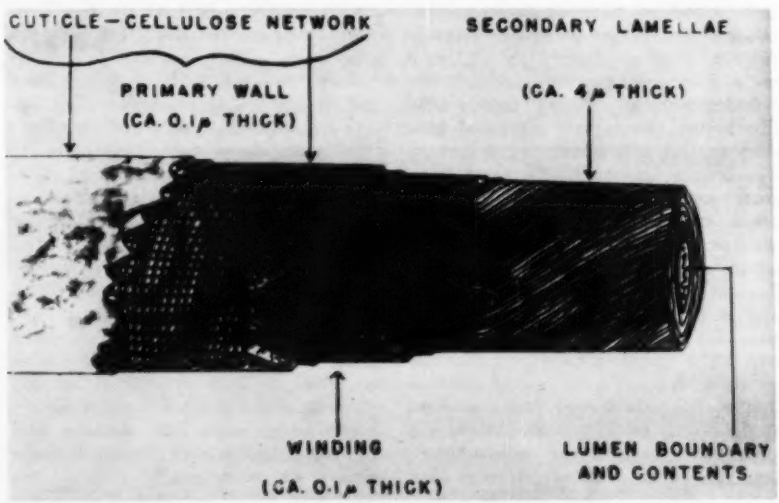


Figure 8
Schematic drawing of the structure of the cotton fiber after Rollins and Tripp (1954)

Figure 9
Electron microscope photograph of a fragment of secondary wall of raw cotton fiber (9600X)

heat-treatment stabilization of the triacetate component had to be carried out under the controlled tension which would produce a smooth fabric, and this was then followed by a "wash-and-wear" crosslinking chemical finishing of the cotton component which would stabilize it in the smooth configuration of the fabric. Figure 6 illustrates this difference after several washes. With this kind of experience as background, the research director would want to make another critical examination of the problems which exist at present with respect to the major textile fiber—cotton.

RESEARCH AND DEVELOPMENT IN SUPPORT OF COTTON

Our research director would be immediately overwhelmed by the mountain of published literature available on the mechanical and chemical treatment of cotton. He would be surely impressed by the outstanding literature search contained in Tovey's (3) "Wrinkle Resistance and Recovery from Deformation"; but even after he had read the 820 references, he would still be confronted with the fact that 1) there is still a great deal to be learned about the fine structure of the cotton fiber, and 2) we do not clearly understand the exact mechanism by which the various classes of crosslinking agents modify the performance characteristics of cotton fabrics related to shrinkage in washing, and wrinkling in dry and wet performance. He would be astounded that, after 15 years of intensive investigation by industrial research laboratories, particularly those associated with the chemical industry supplying finishing chemicals, and by the government and private laboratories, such as Southern Regional Research Laboratory, Textile Research Insti-

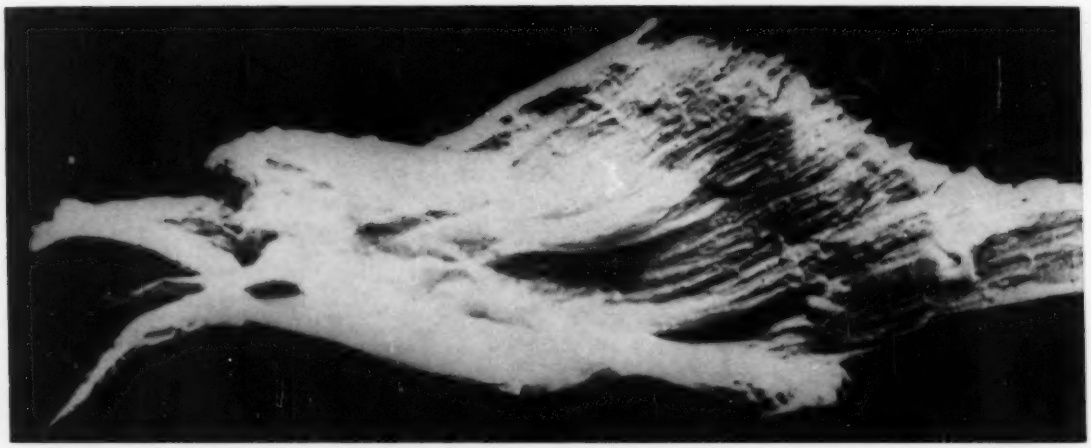


Figure 10
Electron microscope photograph of fragment from cotton fiber taken from DMU-crosslinked fabric (13,500X)

tute and Harris Research Laboratories, that in the year 1961, learned men are still arguing whether bulk polymerization within the internal fiber structure or specific crosslinks between adjacent elements within the fiber are primarily responsible for the important mechanical effects resulting from these treatments. However, he would be greatly encouraged by the progress being made in understanding the fine structure of the cotton fiber and its response to chemical treatment. An early description of the fine structure of the cotton fiber was made by Anderson and Kerr (*4*) in 1938. This is illustrated in Figure 7. Our research director would be indebted to Rollins (*5*), Tripp (*6, 7*), Reeves (*8, 9*), and Orr (*10, 11*), and their many coworkers at the Southern Regional Research Laboratory for much of our present understanding of the cotton fiber illustrated in the more sophisticated drawing in Figure 8.

He would also discover that DuPrè (*12*) has raised several very penetrating questions concerning which of the component parts of the cotton fiber are responsible for certain mechanical properties which may be subsequently modified by chemical treatment. While this work clearly recognized the importance of the microfibril, which in a sense is the fine structure one step above the individual cellulose chains, and of the fibrils, which are bundles of microfibrils, he draws attention to the possible importance of the growth layers which make up the secondary wall of the cotton fiber. In Figure 9, taken from the paper by Tripp et al (*13*), we see an electron microscopic photograph of a single growth layer separated by wet-beaten cotton fiber. Further attrition would have separated this sheath into individual fibrils and perhaps even microfibrils. However, when a chemically crosslinked cotton fiber is subjected to the same wet-beating process, the individual growth layers do not separate and many-layered chunks, as illustrated in Figure 10, are observed, strongly suggesting chemical crosslinking between adjacent growth layers. The difference in the way in which crosslinking chemicals can be distributed among the various elements of the cotton fiber could be of major interest to our research director because it might induce him to support a fundamental-research program aimed at achieving shrinkage resistance and dry and wet wrinkle resistance and recovery with a reduction in the strength loss which now results from chemical finishing of cotton fabrics.

RESEARCH AND DEVELOPMENT FROM THE CHEMICAL INDUSTRY

Our research director will soon discover that the major source, outside of the textile industry itself, of new technical information and of new products is the chemical industry. He will find in many published papers, similar to the one presented by Harris (*14*) at the 1957 AATCC Convention, authoritative analyses which conclude that the textile industry is also the chemical industry's number one customer. Exclusive of the billion pounds of monomers, polymers and related chemicals directly consumed in fiber manufacture, it will be evident that more than one pound of auxiliary chemicals is consumed for every pound of fiber converted into finished fabric. With this multibillion dollar market at stake, our research director would be remiss if he did not direct many of the textile industry's problems to the attention of the research and development laboratories of his chemical suppliers.

Where established fibers are involved, such as cotton, wool, rayon, acetate, nylon, or polyester, he may ask the chemical industry for improved dyes or even new classes of dyes to achieve all of the required performance levels, but at a lower cost, and he may want to improve levels of performance to meet the new demands placed upon the textile industry by changing market demands.

In addition, the chemical industry may be called upon to describe the mechanism of dyeing and even to develop new dyeing processes to insure greater control and/or lower costs. What holds for dyeing and coloration also would apply to chemical finishing, bleaching, and scouring processes. Because of the relatively large number of scientifically trained people available in the chemical industry, our research director might ask for and receive unifying principles of the kind formulated by Valko (*15*) in his paper on "The Principles of Textile Finishing".

Table V, taken from Valko's paper (*15*), summarizes the desired location and the probable location of chemical finishes applied to textile fabrics.

If the applications research man in the laboratory of the chemical manufacturer had an accurate appreciation for the site which his chemical treatment had to reach, he might be in a better position to design the structure of the molecule which will be ultimately sold to the dyer and finisher. On the other hand, the technical man

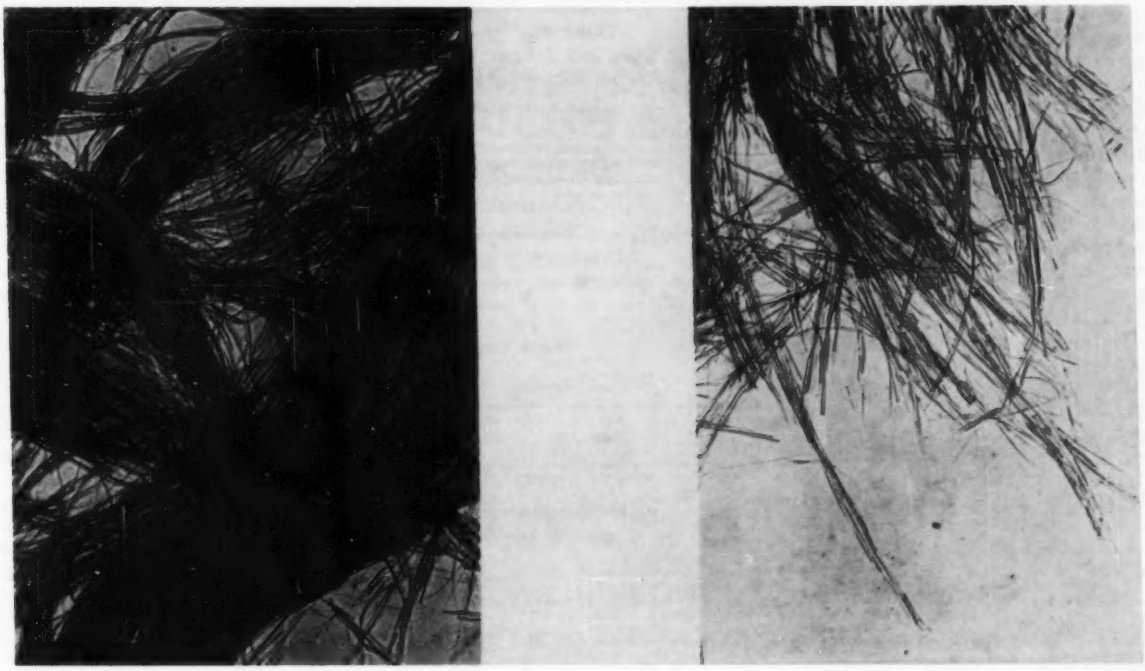


Figure 11
Residual silicone skins from 1% and 2% silicone-treated acetate fabrics extracted for 24 hours with 95/5 acetone/H_2O (200X)

in the commercial dyehouse, or even the boss finisher, if he understood where his finishing chemicals had to go onto and into the fiber, would be in a much better position to determine what padding, drying and curing facilities to use in order to achieve optimum results. As we have noted in Figure 10, the electron microscope has been most useful in locating the distribution of chemical finish, particularly in the cotton fiber. However, the location of surface finishes, especially softening and lubricating agents, can be determined by measuring such indirect properties as sewability. One interesting technique, where insoluble surface films are created in finishing, is illustrated in Figure 11. Cellulose acetate fabrics finished with a silicone polymer and then extracted with acetone to remove the encapsulated cellulose acetate material leaves behind these sheaths of the silicone polymer. Our research director should be most interested in the development of techniques which will more accurately determine where the finishing agents are ultimately located so that more efficient use of these treatments can be obtained.

In addition to Valko's (*15*) attempt to locate the site of finishing effects, he also attempted to describe the chemical and physical nature of the resulting effects of various treatments, as shown in Table VI. In this way he hoped to draw attention to the possibility that chemistry as applied to textile processing could be translated into specific fundamental physical and chemical phenomena. Our research director should be most sympathetic to sponsoring further work in this direction.

TABLE V
Location of finishing effects

Process	*Desirable site*	*Attained site*
Dyeing		
Molecular	intrafiber	intrafiber
Pigment	interfiber or interyarn	interfiber
Softening	interfiber	interfiber and intrafiber
Antislipping	interyarn	interyarn
Water repellence	interfiber	interfiber and intrafiber
Crease resistance	intermicellar	intermicellar
Dimensional stabilization of rayon	intermicellar	intermicellar
Shrinkage control of wool		
Resin treatment	interfiber	interfiber (?)
Chlorination	intrafiber	intrafiber

TABLE VI
Chemical and physical interaction of finish with textile fiber and fabric

1) Restoring, increasing, or creating cohesion of fiber (spun-dyeing, spun-dulling)
2) Restoring, increasing, or creating cohesion of finish (precipitation, coupling, oxidation, polymerization, polycondensation, coagulation, evaporation of solvent, etc)
3) Utilizing attraction forces (adhesion) between fiber and finish (substantivity, ion-exchange)
4) Chemical reaction between fiber and finish (formation of acetals, urethanes, etc, copolymerization)

RESEARCH AND DEVELOPMENT IN THE COMMERCIAL DYEHOUSE

After his first superficial examination of the American dyeing and finishing industry, our research director might be dismayed at the possibility that new process development and the application of basic dyeing and chemical technology could be effectively translated into this important phase of the textile industry. He may even have made a trip through selected European dyehouses and met a num-

ber of development chemists carrying out applications research projects as part of a cooperative program of ten or fifteen dyehouses. He could draw the conclusion that it is too late to expect the American dyehouse to be responsible for the development of its own technology in the solution of its many problems. This conclusion might be largely due to the tremendous pressure being put on the dyehouse for volume production at the lowest possible cost. Superimposed on this would be the greater diversity of fabric constructions, the greater variety of different fibers, and most recently, the high percentage of new and difficult blended fabrics which the American dyer is called upon to process. Our research director might, therefore, yield to the temptation to call upon the fiber producer and the dye and chemical supplier to provide most of the information needed by the American dyer to rapidly and effectively introduce new fibers and fabrics to the trade.

There is some hope, however, that someone might persuade the research director to beware of making the dyehouse completely dependent upon his suppliers for new technology and processing know-how, for he may soon discover that with the relatively small amount of financial support and encouragement from the parent textile industry, the commercial dyehouse could represent a significant opportunity for problem solving and inventiveness. Our research director might come to the conclusion that what the dyehouse needs is not so much a staff of textile chemists who are familiar with and can apply already existing technology, but research and development chemists who can search out major technical shortcomings in the existing technology and modify or create processes based on new chemical and engineering information becoming available from other segments of the textile industry, and perhaps even from the research activities of other industries and academic laboratories. At the very least, our research director will become aware of the fact that, in the total textile industry, the dyehouse has been and will remain a most important and critical factor influencing the flow of new fibers and fabrics through the textile industry to the ultimate consumer. If he is patient and understanding, he may also discover that a majority of the commercial dyehouses are quite capable of adapting even their existing facilities to achieve the performance characteristics required for most end uses, and that it is primarily the pressure for price that forces the dyehouse to use marginal colors and below optimum fabric handling and chemical finishing procedures in order to meet his competition. It is not ignorance but price that accounts for much of the criticism leveled at the technology of the dyehouses. We trust that our research director will find some way of correcting this situation since it affects the health of the total texile industry.

TABLE VII
Dyer and finisher

Dyeing & finishing cost incentive
Adaptability to present equipment
Versatility of shade range including cross, reserve and union dyeing possibilities
Ease of meeting quality standards
Ease of meeting good fastness requirements
Possibility of finishing for various hands

TABLE VIII
Minimum performance requirements

Colorfastness
- Washfastness
- Lightfastness
- Miscellaneous fastness properties (fume fading, perspiration, whiteness retention)

TABLE IX
Minimum performance requirements
Durability & general performance

Strength
Wear resistance
Pilling resistance
Chemical & photochemical resistance
Glazing & heat resistance
Fire resistance
Sewability & seam strength
Ease of pressing & forming
Soil resistance & ease of soil removal

THE MACHINE MANUFACTURER AND THE CUTTER

By this time our research director may have sufficient challenge to occupy himself and the total research and development budget of the textile industry. However, we hope that he will find a place in his long-range planning budget to make a critical examination of the machinery manfacturing industry in order to insure that important mechanical phases of the textile industry are not neglected and become obsolete. Too many aggressive and younger industries are competing for the attention of the machinery manufacturing industry, and a conscious effort will have to be made to combat this trend.

Our research director will suddenly discover that the needle trades or the cutter segment of the textile industry has been largely neglected except perhaps by machine suppliers of such machines as the sewing machine and multifabric cutters. Otherwise, relatively little change has taken place in this phase of our industry. The creation of new fabrics which behave differently from cotton and wool on the cutting table and in the steam-pressing operation create serious problems in the efficient and economical movement of volume fabrics. Perhaps our research director will find ways of bringing technical information concerning the behavior of new and important fibers and fabrics in the cutting operation to the attention of technical people associated with the cutting up trade. If this does not happen, then the expense and lack of efficiency of these operations could seriously penalize all of the contributions made in those phases of the textile industry which come before the cutter.

PREDICTING THE COMMERCIAL SUCCESS OF A NEW FIBER

Perhaps the most difficult task confronting our research director will be one of marshaling sufficient facts in predicting the commercial acceptance of a new fiber coming out of the fiber producer laboratories. In preparing himself for this responsibility, he may have read the paper on this subject by Barach, Stoll and Tesi (*16*). He will then truly be confronted by the complexity of the textile industry because, not only must he relate fundamental fiber properties to the ultimate end-use fabric performance characteristics required by the current market, but he will have to consider those factors which influence the finished goods merchant as well as the spinner, the knitter, the weaver and the dyer and finisher. In every case the question of comparative costs, ease of processability, and ultimate sales appeal must be taken into consideration. Typical check-off lists he will examine are represented in Tables VII, VIII and IX, as well as the "ease-of-care" properties listed in Table III. In every instance his attempt to predict the commercial acceptance of a new fiber will have to be made against a background of competition with existing fibers. He will, therefore, have to have accurate and critical information available from every phase of the textile industry.

(*concluded on page 42*)

1961 Convention———

A CARBAMATE FINISH FOR WRINKLE-RESISTANT AND "WASH-AND-WEAR" COTTONS*

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J DAVID REID, and GLORIA A GAUTREAUX
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A finishing agent for cotton fabric has been prepared from the reaction of two molar equivalents of formaldehyde with a monocarbamate, typically ethyl carbamate (urethane). The N,N-dimethylolcarbamate is presumably formed in the reaction. The finish gives cotton wrinkle resistance and "wash-and-wear" properties without susceptibility to chlorine damage. In addition, the finish is very durable in comparison with other nitrogenous finishes, particularly because of its high resistance to acids and laundry sours.

INTRODUCTION

IN the Southern Utilization Research and Development Division, many types of finishing agents have been investigated in attempts to produce improved "wash-and-wear", and wrinkle-resistant cotton fabrics. Several variations of the usual methylol amide agents were among those studied. One class investigated was the dimethylol derivatives of dicarbamates, exemplified by ethylene bis(N-methylolcarbamate) shown in Figure 1. This agent proved to be efficient in producing wrinkle resistance and "wash-and-wear" properties. In addition, it showed a relatively high resistance to acidic hydrolysis. This property should give the finish a good resistance to "souring," the acid rinse responsible for the removal of most methylol amide finishes in commercial laundering. Although an ester group is present, resistance to alkaline hydrolysis was sufficient to make the finish durable to high-temperature soap laundering. The overall durability of the finish should be better than nitrogenous finishes now in use. As may be expected from the structure of the agent, however, the finish gave the fabric a high susceptibility to chlorine damage in the AATCC "scorch" test.

To eliminate or reduce the chlorine sensitivity, replacement of the amido hydrogens by methyl groups was tried. Ethylene bis(N-methylol-N-methylcarbamate), shown in Figure 2, was the agent formed by this substitution. This expedient was tried without much confidence as previous experience has shown that noncyclic alkyl substituents on the amido group reduce the efficiency of the agent in the crosslinking reaction. Much less improvement in crease-recovery angles is obtained. In addition, since, the unreacted methylol groups are easily cleaved, the expected chlorine resistance is not obtained.

The results obtained on treatment of cotton fabric with the N-methyl and unmethylated methylol dicarbamates with zinc nitrate catalyst are shown in Table I. Crosslinking efficiency was reduced by introduction of the methyl groups, as indicated by the differences in crease-recovery angles. The AATCC scorch test, however, showed that the fabric finished with the N-methylated carbamate was not susceptible to chlorine damage. This unexpected result was even more interesting when the fabric with this finish was found to contain 0.15% active chlorine after hypochlorite bleaching, an amount usually sufficient to cause extensive damage. The ethylene bis(N-methylol-N-methylcarbamate) finish, then, is chlorine retentive, but the retained chlorine does not cause fabric damage under the conditions of the AATCC test. In this respect it is similar to finishes like the triazones.

Underlined in Figure 3 are the groups believed to be chlorine-retentive in these two carbamate finishes. These groups are the N-oxymethylenecarbamate group with the unmethylated carbamate, assuming the

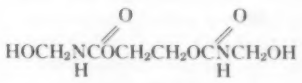

Figure 1
Ethylene bis(N-methylolcarbamate)

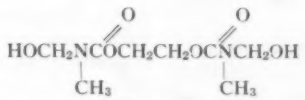

Figure 2
Ethylene bis(N-methylol-N-methylcarbamate)

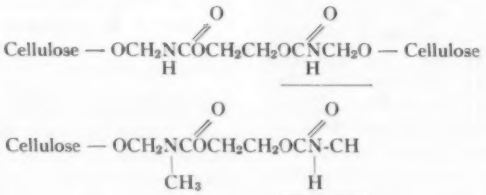

Figure 3
Chlorine-retentive groups in dicarbamate finishes

TABLE I
Properties of fabric finished with dimethylol dicarbamates

Agent (% *in solution*)	*Nitrogen content of fabric* (%)	*Crease-recovery angles* (*W+F*) (*degrees*)	*Strength retained in AATCC scorch test* (% *of original*)
Ethylene bis (N-methylolcarbamate) (12%)	1.18	282	55
Ethylene bis (N-methylol-N-methyl carbamate) (13.6%)	0.94	260	109

*Presented September 27, 1961 at the AATCC Convention held at the Statler-Hilton Hotel, Buffalo, NY

[1]One of the laboratories of the Southern Utilization Research and Development Division, Agricultural Research Service, US Department of Agriculture.

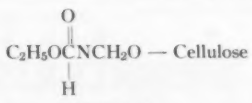

Figure 4
Reaction product of ethyl N-methylolcarbamate on cotton

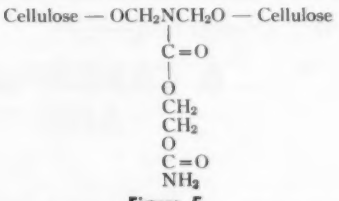

Figure 5
Alternate structure of crosslink formed by ethylene bis (N-methylolcarbamate)

usual type methylol amide crosslink is formed, and the N-methylcarbamate group with the N-methylated carbamate from an incomplete crosslinking reaction. The question then arose as to why the chlorine retained by these apparently similar groups should differ in properties. In one case it caused fabric damage, and in the other it did not.

Two possible answers to the question were considered. First, the two groups in spite of their apparent similarities are appreciably different chemically. Second, some other group, as yet unconsidered, retains the damaging chlorine in the finish produced by the unmethylated carbamate. To determine which of the two answers was more likely, ethyl N-methylolcarbamate was applied to cotton fabric. This monofunctional agent should introduce nitrogenous groups, as shown in Figure 4, similar to those believed formed by the unmethylated dicarbamate. The treated fabric showed little damage in the AATCC test — 96% of original strength was retained after scorching. From this result, it was judged that the second of the two explanations was the more likely.

Further thought was then given to other possible chlorine-retentive groups that could result from the reaction of the unmethylated methylolcarbamate with cellulose, but that could not result from the reaction of the N-methyl N-methylolcarbamate. For this, it was necessary to consider other structures for the crosslink formed by the dicarbamate. One possible structure is shown in Figure 5. Here a crosslink is formed through a single carbamate group and the remainder of the molecule, including the other carbamate group, is an appendage on the crosslink. This structure leaves a primary amide, or carbamate group, to act as the chlorine-retentive group. This group cannot occur in the finish produced by the N-methylcarbamate.

A crosslink structure, as shown in Figure 5, is not the type usually postulated in cellulose crosslinked with methylol amides. It is not unique, however. In other work at this Laboratory, this type of crosslink has been shown to occur in finishes produced by dimethylol-formamide (*1*).

If crosslinks of this structure are actually formed, the second carbamate group is unnecessary for crosslinking. It should be possible, then, to form a dimethylol derivative of a monocarbamate and to crosslink cellulose with such an agent. The finish so produced would not contain the chlorine-retentive group of the dicarbamate finish, and if the high acid resistance is retained, should be an attractive new crosslinking finish for cotton.

Further investigation showed that a crosslinking agent can be prepared from a monocarbamate, typically ethyl carbamate (urethane), and two molar equivalents of formaldehyde. This agent is presumably ethyl N,N-dimethylolcarbamate, and will be referred to as such, although the dimethylol compound has not been actually isolated and characterized. The agent produces high crease-recovery angles on cotton fabric with good "wash-and-wear" properties and, as expected, does not cause chlorine damage in the AATCC test. Acid resistance of the finish is still relatively high. Furthermore, the cost of ethyl carbamate, prepared from ethyl alcohol and urea, should be in the range of other commonly used commercial crosslinking agents.

In the remainder of this article, the methods of preparation and application of this agent are presented, and a detailed description is given of the properties obtained with the finish on cotton fabric.

MATERIALS AND METHODS

All fabric samples included in this study were prepared from desized, caustic-boiled and bleached 80 × 80 white cotton printcloth, 3.2 oz/sq yd. Impregnation of the fabric was accomplished by immersion of the fabric in an aqueous solution containing the finishing agent and catalyst, followed by passing through pad rolls to approximately 70% wet add-on.

The samples were then mounted on pin frames at original dimensions and dried and cured in ovens with circulating hot air. Unless specifically noted in the tables, the samples were dried at 60°C for seven minutes and cured at 160°C for three minutes.

After curing, the samples were washed in an automatic home washer at 40°C with approximately 0.03% of a nonionic detergent and were then tumble dried.

Physical testing was performed by standard methods of ASTM with breaking strength determined on strips raveled to 80 threads (*2a*) and tearing strength by the Elmendorf method (*2b*). Wrinkle-recovery angles were measured using the Monsanto tester (*2c*). Nitrogen content was determined by the Kjeldahl method, formaldehyde by the method of Roff (*3*), and total chlorine as described by Cheng (*4*). "Home laundering" was performed in the usual type of home automatic washer using household detergent (Tide)[2], and hypochlorite bleach to give 0.02% available chlorine in the wash water. A more rigorous, high-temperature laundry procedure prescribed by AATCC (*5a*) was also used. "Wash-and-wear" properties were estimated by comparison with plastic replicas using the method prescribed by AATCC (*5b*).

The damage due to retained chlorine was determined by the AATCC "scorch test" method (*5c*). The available chlorine content of fabric after hypochlorite bleaching was determined by a titration procedure (*6*).

The finishing agent from ethyl carbamate was prepared by the reaction of two moles of formaldehyde with one mole of ethylcarbamate, and sufficient water to make a 30% solution at pH 8-8.5. After standing overnight at room temperature, the solution was neutralized and diluted for use. The other carbamate agents were prepared similarly.

EXPERIMENTAL RESULTS

To establish the optimum add-on for further study of the ethyl N,N-dimethylolcarbamate (DMC) finish on cotton fabrics, samples were treated with various concentrations of DMC

[2]Use of a company and/or product name by the Department does not imply approval or recommendation of the product to the exclusion of others which may also be suitable.

and zinc nitrate catalyst as shown in Table II. The fabric properties obtained indicated that both the 10% and 13.5% ethyl N,N-dimethylol carbamate treating solutions produced fabrics with good wrinkle resistance and chlorine resistance, both of which were durable to laundering. "Wash-and-wear" ratings of 4 were obtained initially and then fell to 3 after repeated launderings. Although the original fabric treated with the 7.5% solution had good wrinkle and chlorine resistance, these properties were not durable to laundering. On the basis of these results a 10% solution was used in further studies.

CURING TEMPERATURE —— The effect of curing temperature was investigated using samples padded with 10% ethyl N,N-dimethylolcarbamate and 3.0% magnesium chloride hexahydrate catalyst. Samples were cured for three minutes at 140, 150 and 160°C, and given an after-wash. The fabric properties given in Table III show that a 140°C cure produces a fabric with moderate wrinkle resistance and fair durability to laundering. It did, however, suffer some damage in the scorch test after 20 home launderings. A curing temperature of 160°C was used in preparing the remainder of the samples for this study. The data indicate, however, that curing at 150°C can give satisfactory results.

CATALYSTS —— A comparison of the data in the previous tables shows that at equal crease-recovery angles, fabric treated with magnesium chloride catalyst had higher tearing and breaking strengths than fabric treated with zinc nitrate. In order to show more clearly the effects of catalysts on fabric properties, a series of samples were prepared using the two previously mentioned catalysts and an amine hydrochloride catalyst at three concentration levels in a 10% ethyl N,N-dimethylolcarbamate solution. The fabric properties before and after laundering are given in Table IV. Included in the table, for comparison, are untreated fabric and fabric treated with dimethylol ethyleneurea, taken as an example of a familiar finishing agent. All the carbamate treatments produced about the same crease-recovery angles and durability. Good "wash-and-wear" properties were obtained, although not quite equal to those obtained using dimethylolethyleneurea. All carbamate-treated fabrics resisted damage in the AATCC chlorine-resistance test, although all retained active

TABLE II

Effect of add-on on properties of fabric treated with ethyl N,N-dimethylolcarbamate

Property	Laundering	Treatment: 7.5% DMC, 0.4% $Zn(NO_3)_2 \cdot 6H_2O$	Treatment: 10% DMC, 0.5% $Zn(NO_3)_2 \cdot 6H_2O$	Treatment: 13.5% DMC, 0.6% $Zn(NO_3)_2 \cdot 6H_2O$
Nitrogen content (%)	None	0.47	0.62	0.81
	20 Home	0.38	0.53	0.73
	5 AATCC	0.39	0.53	0.72
Crease-recovery angle (w+f, degrees)	None	258	263	262
	20 Home	199	248	247
	5 AATCC	235	244	254
Tearing strength (w+f, gr)	None	980	847	793
	20 Home	840	740	673
	5 AATCC	1050	1077	980
Breaking strength (warp, lbs)	None	37.2	33.6	34.0
	20 Home	37.9	36.3	33.1
	5 AATCC	38.9	32.1	35.7
% Original strength retained in scorch test	None	92	96	102
	20 Home	98	97	87
	5 AATCC	46	93	98

TABLE III

Effect of curing temperature on properties of fabric treated with ethyl N,N-dimethylolcarbamate[1]

Property	Launderings	Curing Temperature (°C): 140	150	160
Nitrogen content (%)	None	0.58	0.59	0.59
	20 Home	0.48	0.54	0.54
	5 AATCC	0.55	0.56	0.56
Crease-recovery angle (w+f, deg)	None	247	262	262
	20 Home	230	246	248
	5 AATCC	237	264	256
Tearing strength (w+f, gr)	None	1127	1053	953
	20 Home	847	800	727
	5 AATCC	1086	960	940
Breaking strength (warp, lbs)	None	42.2	39.9	35.2
	20 Home	37.0	37.3	35.4
	5 AATCC	34.8	33.7	32.2
% Original strength retained in scorch test	None	92	92	92
	20 Home	75	92	94
	5 AATCC	86	88	94

[1] 10% DMC, 3.0% $MgCl_2 \cdot 6H_2O$.

TABLE IV

Effect of catalyst and catalyst concentration on properties of fabric treated with ethyl N,N-dimethylolcarbamate[1]

Property	Launderings	Catalyst (% in solution): $MgCl_2 \cdot 6H_2O$ 1.5%	$MgCl_2 \cdot 6H_2O$ 3.0%	$MgCl_2 \cdot 6H_2O$ 4.5%	$Zn(NO_3)_2 \cdot 6H_2O$ 0.5%	$Zn(NO_3)_2 \cdot 6H_2O$ 0.75%	$Zn(NO_3)_2 \cdot 6H_2O$ 1.0%	$RNH_3 \cdot HCl$[2] 0.5%	$RNH_3 \cdot HCl$[2] 1.0%	$RNH_3 \cdot HCl$[2] 1.5%	DMEU[3]	Untreated fabric
Nitrogen content (%)	None	0.56	0.59	0.62	0.62	0.61	0.61	0.56	0.60	0.57	1.21	—
	20 Home	0.55	0.54	0.55	0.53	0.54	0.55	0.53	0.54	0.52	1.15	—
	5 AATCC	0.52	0.56	0.56	0.53	0.57	0.58	0.56	0.54	0.55	1.12	—
Crease-recovery angle (w+f, deg)	None	261	262	276	263	274	272	264	268	274	299	196
	20 Home	244	248	265	243	246	258	250	261	261	261	166
	5 AATCC	259	256	277	244	267	277	263	273	278	274	195
Tearing strength (w+f, gr)	None	1037	953	900	847	787	754	1000	847	820	813	1867
	20 Home	760	727	680	740	667	600	760	660	607	600	1107
	5 AATCC	986	940	873	1077	866	827	967	853	793	820	1673
Breaking strength (w, lbs)	None	38.2	35.2	33.7	33.6	33.1	27.2	34.0	33.4	31.5	30.7	43.8
	20 Home	38.1	35.4	33.8	36.3	32.1	29.1	37.0	32.0	34.0	30.7	45.0
	5 AATCC	36.8	32.2	32.0	32.1	26.8	27.8	33.8	27.5	28.1	30.0	47.8
% Original strength retained in scorch test	None	97	92	100	96	84	100	91	91	99	—	—
	20 Home	85	94	93	97	95	100	93	96	96	—	—
	5 AATCC	94	94	100	93	100	89	85	100	93	—	—

[1] 10% DMC in treating solution.
[2] 8% DMEU — 0.6% $Zn(NO_3)_2 \cdot 6H_2O$ in treating solution.
[3] Monsanto Catalyst AC.

chlorine. Available chlorine contents after bleaching by the AATCC test on fabrics treated with catalysts at the medium concentration were 0.16-0.20% before laundering, 0.17-0.22% after five AATCC launderings, and 0.37-0.44% after 20 home launderings. None of the samples showed yellowing or discoloration in the scorch test.

Tearing strengths of the fabrics with the carbamate finishes shown in Table IV were the same or better than that obtained with dimethylol ethyleneurea except those treated with the two highest concentrations of zinc nitrate. Breaking strengths were also as high or higher with the carbamate except for the sample treated with the high concentration of zinc nitrate.

TREATMENT MODIFICATIONS——The results of two modifications of the carbamate treatment are shown in Table V. In one of these treatments a softener, emulsified polyethylene, is included. In the other, a 10% excess formaldehyde, that is, 2.2 moles formaldehyde to each mole ethyl carbamate, is used in the preparation of the finishing agent. The use of softener increases the crease-recovery angles and tearing strength as is usual with softening agents. Small adverse effects are observed on other properties.

The use of excess formaldehyde drives the reaction with ethyl carbamate further to completion, increasing the proportion of ethyl N,N-dimethylolcarbamate in the treating bath. A more effective agent is thereby produced. This is shown by the higher nitrogen contents and crease-recovery angles.

Both variations, the use of softener and the use of excess formaldehyde raised the "wash-and-wear" ratings approximately one unit, that is, the ratings were 5 before laundering and 4 after extensive laundering. Probably the most effective treatment would be one incorporating 10% excess formaldehyde and a softening agent. The excess formaldehyde, however, will increase the amount of gaseous formaldehyde released on drying.

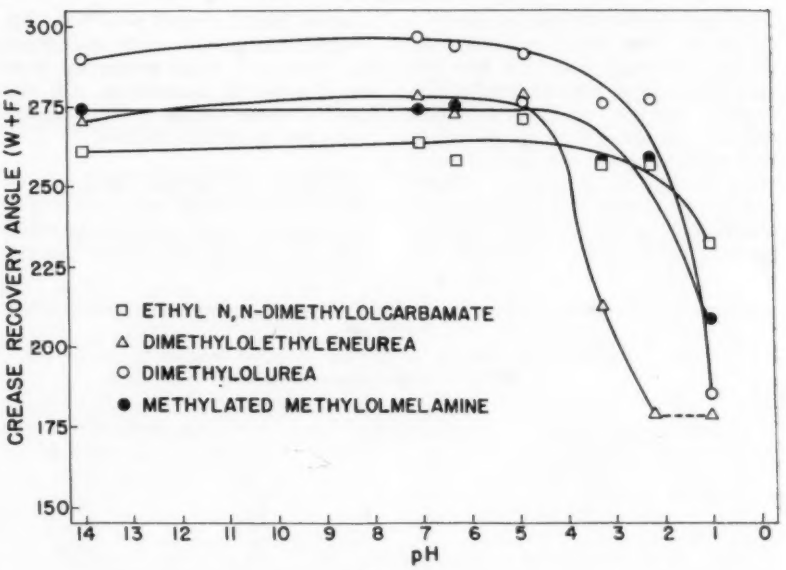

Figure 6
Blue reflectance of brightened fabrics measured by different instruments.

OTHER CARBAMATES——In addition to ethyl N,N-dimethylolcarbamate, agents were prepared from other alkyl carbamates and formaldehyde. As before, they were prepared from the reaction of two molar equivalents of formaldehyde with the carbamate, and were applied to fabric by the same procedures used with the ethyl N,N-dimethylolcarbamate. The properties of the fabrics obtained are shown in Table VI, and are essentially the same as obtained with ethyl N,N-dimethylolcarbamate.

HYDROLYTIC STABILITY——In the preceding tables, it has been shown that the finish obtained with ethyl N,N-dimethylolcarbamate is durable to alkaline laundering. When a "wash-and-wear" or wrinkle-resistant cotton is subjected to the usual commercial laundering procedure, the finish is quite often removed. This has been shown to be caused mainly by hydrolysis during souring, which in practice is often quite acidic (7). In Figure 6, the resistance of the carbamate finish to acid hydrolysis is compared with the resistance of three common finishes, those produced by dimethylolurea, dimethylolethyleneurea, and a methylated methylolmelamine. The data for the plot were obtained from fabric samples which were agitated in a solution of the indicated pH for 30 minutes at 40°C. The relatively high resistance of the carbamate finish to acid hydrolysis is shown by the plot. For instance, after treatment at pH 1, the extreme case, the ethyleneurea-finished fabric retains none of the wrinkle resistance originally imparted, the urea-finished fabric retains 6%, the melamine-finished fabric retains 31%, and the carbamate-finished fabric retains 63%. This resistance to acidic hydrolysis should give the carbamate finish a markedly greater resistance to removal in commercial laundering.

On the alkaline side of the hydrolysis plot, none of the finishes showed susceptibility to hydrolysis as far as crease-recovery angles are concerned.

TABLE V
Properties imparted by modified ethyl N,N-dimethylolcarbamate treatments

		Treatment		
Property	*Launderings*	*10% DMC 3% $MgCl_2 \cdot 6H_2O$ 1.5% Polyethylene*	*10% DMC + 10% excess HCHO 3% $MgCl_2 \cdot 6H_2O$*	*1% $RNH_2 \cdot HCl$*
Nitrogen content (%)	None	0.58	0.67	0.65
	20 Home	0.55	0.62	0.58
	5 AATCC	0.57	0.61	0.60
Crease-recovery angle (w+f, deg)	None	284	277	272
	20 Home	266	269	266
	5 AATCC	272	278	280
Tearing strength (w+f, gr)	None	1053	826	773
	20 Home	900	640	593
	5 AATCC	987	850	767
Breaking strength (w, lbs)	None	34.0	30.9	30.4
	20 Home	32.1	31.4	31.3
	5 AATCC	31.8	28.1	24.7
% Original strength retained in scorch test	None	88	100	100
	20 Home	89	96	100
	5 AATCC	100	94	95

TABLE VI
Properties of fabric treated with some dimethylolcarbamates[1]

Carbamate	Nitrogen content (%)	Crease-recovery angle (w+f) (deg)	Tearing strength (warp) (gr)	Strength retained in scorch test (%)
Methyl	0.57	250	627	101
n-propyl	0.56	249	580	102
n-butyl	0.64	254	527	91

[1] Dimethylolcarbamates were applied in concentrations equivalent to 10% DMC using 3% $MgCl_2 \cdot 6H_2O$ as catalyst.

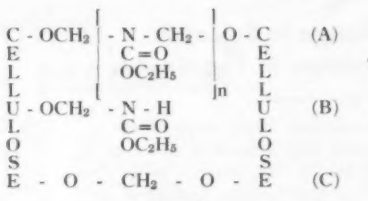

Figure 7
Products from reaction of ethyl N,N-dimethylolcarbamate and cotton

TABLE VII
Analysis of ethyl N,N-dimethylolcarbamate-treated fabric

Catalyst	Original N (%)	Original HCHO (%)	Original HCHO/N	After 20 home launderings N (%)	After 20 home launderings HCHO (%)	After 20 home launderings HCHO/N	After 5 AATCC launderings N (%)	After 5 AATCC launderings HCHO (%)	After 5 AATCC launderings HCHO/N	After acid strip[1] N (%)	After acid strip[1] HCHO (%)	After acid strip[1] HCHO/N
3% $MgCl_2 \cdot 6H_2O$	0.59	1.76	1.39	0.54	1.64	1.42	0.56	1.68	1.40	0.04	0.19	2.16
0.75% $Zn(NO_3)_2 \cdot 6H_2O$	0.61	1.88	1.44	0.54	1.70	1.47	0.57	1.65	1.35	0.10	0.24	1.12
1.0% $RNH_3 \cdot HCl$	0.60	1.68	1.31	0.54	1.62	1.40	0.54	1.60	1.38	0.10	0.31	1.43

[1] 0.1N HCl, 40 minutes at 66°C.

STRUCTURE OF REACTION PRODUCTS WITH COTTON—— Possible structures of the reaction products of the dimethylolcarbamate with cellulose are shown in Figure 7. Structure A is a nitrogenous crosslink formed by the dimethylol derivative. Structure B is a grafted group formed by a monomethylol derivative, or by incomplete reaction of a dimethylol derivative and subsequent loss of an unreacted methylol group. Structure C is a crosslink formed by free formaldehyde in the treating solution, or released on the fabric. Reaction of the ester group has been excluded because similar treatments with ethyl carbamate without formaldehyde did not fix nitrogen on the fabric. Also a treatment with 2-chloroethyl, N,N-dimethylolcarbamate gave a fabric with 0.59% nitrogen, and 1.31% chlorine, about a one to one atomic ratio.

The composition of the finish obtained with ethyl N,N-dimethylolcarbamate, in terms of formaldehyde and nitrogen contents, is given in Table VII. With all catalysts, the unlaundered and laundered fabrics show a formaldehyde-to-nitrogen ratio of about 1.4. The average size of the crosslink in structure A then can have a maximum of about two carbamate units. The size cannot be specified exactly because of the presence of structure B and C to an unknown extent. Structure B is required to explain the chlorine retention on hypochlorite treatments, that is, the active chlorine retained on the fabric, not the fabric damage produced by the treatment. The presence of structure C is indicated in Table VII by the retention of about 0.2% formaldehyde not associated with nitrogen after a rather strong acid strip. Structure A rather than C is believed to be the predominant crosslink structure as the properties of the finish differ greatly from formaldehyde finishes, and the amount of formaldehyde indicated is less than should be required for the crease-recovery angles obtained. These reaction products are similar to those described for a formamide-formaldehyde finish (*1*). In the carbamate finish, however, there seems to be a lower proportion of formaldehyde crosslinks, structure C, and the retained chlorine does not lead to fabric damage as it does in the formamide finish.

SUMMARY

As a result of investigations on the crosslinking of cotton with dimethylol dicarbamates, it was concluded that dimethylol monocarbamates could be formed and would crosslink cotton. Furthermore, these dimethylolcarbamates should not cause a susceptibility to damage from hypochlorites, although they are actually chlorine retentive. These conclusions were verified experimentally. The monocarbamate derivatives gave the results expected and, in addition, the crosslinks produced had a high resistance to acidic hydrolysis.

These results led to the development of a new finishing agent for producing wrinkle-resistant and "wash-and-wear" cotton. The agent is prepared from ethyl carbamate, or urethane, and formaldehyde and is presumably ethyl N,N-dimethylolcarbamate. This agent can be applied by the usual pad, dry, cure procedure and should be inexpensive. The finish produced has good durability to home laundering and, because of its resistance to acids and "souring", should have good resistance to commercial laundering in comparison with other nitrogenous finishes.

ACKNOWLEDGMENT

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A Challenge to Scientific Investigation in the Textile Industry———

(concluded from page 36)

If by now our research director is not sufficiently impressed with the diversity of the textile industry and its opportunity for research and development, we will list for him ten areas of exploration. Some of these he has confronted in his examination of the various phases of the textile industry.

1) What additional information must we have concerning the fine structure of the cotton fiber in order to insure optimum fabric performance as a result of chemical and mechanical modifications?
2) Is wool doomed to extinction or can it remain a vital factor in textile applications through more effective exploitation of its intrinsic properties by chemical or mechanical modification, and by better engineering design of blends with synthetic fibers which supplement and enhance wool's natural desirable properties?
3) How must we increase our knowledge of the nature of and interactions between the internal molecular and structural elements of man-made polymers as related to the performance of resultant fibers and fabrics in dyeing, thermal and chemical modification in the dyehouse, and performance in service as garments?
4) What are the most exact mechanisms by which cellulosic fibers can be chemically modified to improve drying and wet performance but with minimum strength loss?
5) What do we know about the soiling of textile materials in service, and about soil retention and removal in cleaning, and will it be possible to develop antisoiling chemical treatments?
6) Are we ready to treat textile fibers as engineering building materials for the design of optimum performing blended fabrics with versatile color-styling potential?
7) What are the mechanisms by which dyes degrade on exposure to light and atmospheric chemical contaminants, and how can we inhibit each of these reactions?
8) What is the mechanism of dyeing hydrophobic fibers with disperse nonionic dyes?
9) How can we characterize sensory and aesthetic qualities such as hand, drape, luster, and comfort?
10) What factors must be considered in predicting the potential commercial success of a new or a modified textile fiber?

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AATCC Calendar

COUNCIL; NATIONAL COMMITTEES
Nov 17 (Hotel Sherman, Chicago, Ill); Council and Annual Meeting (2 PM)
Jan 26 (Hotel Commodore, New York, NY); Council (10 AM)
Apr 12-13 (Francis Marion Hotel, Charleston, SC); Council, administrative and research committees

NATIONAL CONVENTIONS
Nov 14-17, 1962 (Atlanta Biltmore Hotel, Atlanta, Ga); Oct 30-Nov 2, 1963 (Boston, Mass); Oct 1-3, 1964 (Hotel Statler, New York, NY); Oct 14-16, 1965 (Conrad Hilton Hotel, Chicago, Ill); 1966 (Philadelphia, Pa)

DELAWARE VALLEY SECTION
Dec 1 (Beck's Restaurant, Philadelphia, Pa)

HUDSON-MOHAWK SECTION
Nov 17 (Albany—Nopco, Fiber Lubricants); Jan 12 (Amsterdam—Monforts Reactor and the Jet Dyeing Machine); Mar 9 (Amsterdam—Water Repellents, 3M); May 25 (Albany—Historical Aspects of Dyeing); June 22 (Amsterdam—Annual Outing)

MID-WEST SECTION
Nov 18 (Chicago, Ill)

NORTHERN NEW ENGLAND SECTION
Dec 18 (Motel 128, Dedham, Mass); Jan 19 (Woodlawn Country Club, Newton, Mass)

METROPOLITAN SECTION
Nov 17 (Suburban Golf Club, Union, NJ—Plant visit to Shell Chemical Co Laboratories; lectures on "Laboratory Evaluation of New Creaseproofing Agents Using Statistical Techniques" by G R Ferrante, "Effect of Alternate Desizing Techniques on Properties of Various Fabrics" by H W Eastwood, and "Radio-tracer Methods in the Textile Industry" by R E Murdock, all of Shell Chemical Co); Jan 19 (New York, NY—"Costs", D M Lewis, Colonial Piece Dye Works); Feb 16 (New York, NY); April 13 (Ladies Night—Margaret Ingersol, *Vogue*); May 18 (Kohler's Swiss Chalet, Rochelle Park, NJ—"Nonwovens—Dyeing and Finishing", panel); June (Outing)

PACIFIC NORTHWEST SECTION
Nov 10 (business meeting)

PACIFIC SOUTHWEST SECTION
Nov 17

PALMETTO SECTION
Jan 20-21 (Poinsett Hotel, Greenville, SC); April 14-15, 1962 (Francis Marion Hotel, Charleston, SC)

PIEDMONT SECTION
Jan 27 (Hotel Charlotte, Charlotte, NC); Apr 7 (Hotel Barringer, Charlotte, NC); June 8-9 (1962 Outing—Mayview Manor, Blowing Rock, NC); Sept 29, 1962 (Hotel Barringer, Charlotte, NC)

RHODE ISLAND SECTION
Dec 1 (Annual Business Meeting)

SOUTHEASTERN SECTION
Nov 25 (Atlanta Athletic Club, Atlanta, Ga)

WASHINGTON SECTION
Dec 8 (Harris Research Labs, Washington, DC—S J Kennedy, QM R&E Section, speaker)

WESTERN NEW ENGLAND SECTION
Dec 1 (Shelton, Conn)

Minutes of 205th Meeting
TECHNICAL COMMITTEE ON RESEARCH

THE 205th Meeting of the Technical Committee on Research was convened at 2 pm on Friday, April 21, 1961 in the University Ballroom of the Jack Tar Hotel, Durham, North Carolina, with the vice chairman presiding. The following members were present:

F Fortess, *Vice Chairman*, TCR
C A Sylvester, *Chairman*, ECR

W D Appel	E Morrill
J R Bonnar	J D Mosheim
D G Carmichael	A C Nuessle
B K Easton	J J O'Neill Jr
N F Getchell	W G Parks
V B Holland	F A Prisley
W A Holst	C N Rabold
C Hooper	L C Reynolds
H Y Jennings	R E Rupp
A E Johnson	V S Salvin
L T Kelly	F T Simon
J C King	J N Sivertson
V D Lyon	L L Wyss
G J Mandikos	C L Zimmerman

Others present:

C Brown	E M Eddington
A M Campbell	N D Lincoln
A B Craig	T W Mooney

After calling the meeting to order, Mr Fortess asked for approval of the minutes of the 204th TCR meeting as published. A motion to this effect was made and seconded. The motion was adopted.

COMMITTEE RA62, WATER ABSORBENCY

J N Sivertson, chairman, presented the following report:

"A large number of water absorbency tests for textile materials have been reviewed by the Committee. In the course of this work it soon became obvious that there are nearly as many absorbency tests as there are end uses for textile materials where absorbency enters the picture.

"To bring some sort of order out of this chaotic condition, the Committee attempted to classify factors which affect the various end uses of absorbent textile materials and which should be considered in the design of the apparatus. In spite of the many end uses, it was apparent that there are relatively few basic factors which are actually important in the design of an absorbency apparatus. These include: 1) the relative area of fabric in contact with the liquid, 2) the relative time the fabric is in contact with the liquid, 3) the quantity of liquid involved, and 4) the direction from which the liquid enters the fabric. Other factors, such as pressure on the fabric and temperature, can usually be adjusted without requiring significant changes in testing apparatus and were not included in the above list. If each of these factors are considered at two levels, there are sixteen possible combinations.

"By carefully analyzing a large number of examples of absorbent textile end uses with respect to each of the four factors and each of the two levels, a simple numerical system was found which could be used to classify all of the examples considered. The Committee was actually unable to find examples for every possible classification; but, at the same time they were also unable to find situations which failed to be classified by the system. It is recognized, nevertheless, that both of these possibilities may exist.

"On the basis of this classification system it would first appear that at least sixteen different tests or pieces of apparatus might be necessary to test all absorbency applications but there are ways to reduce this number. For example, when the area of fabric in contact with the liquid is relatively large or small, provisions should be made for introducing the water over either a large or small area. In this instance, different size test cells for the same basic apparatus should suffice. Likewise, the period of time the fabric is in contact with the liquid becomes of secondary importance since the test may be stopped after any given time interval.

"Thus, while these factors, per se, are important, the basic apparatus need not necessarily be changed to allow for all possible variations in these factors.

"Under certain conditions the quantity of liquid involved may be regulated without a major change in the apparatus, but under certain conditions this may be a governing factor in the design of absorption apparatus. Last of the four factors—namely, the direction from which the water enters the fabric—will definitely affect test results and must be considered in the design of absorption apparatus. Introduction of liquid from beneath the fabric imposes no particular problem, but the introduction of the liquid from above the fabric is more difficult if a completely automatic apparatus is to be devised.

"To summarize, the ideal absorption apparatus should have provisions for introducing the liquid at one small area or alternatively over the entire area of the fabric. In addition, it should be possible to introduce the liquid from either the top or bottom of the fabric. The Committee is in agreement that the apparatus should also be automatic and produce a graphical record of the test, if feasible.

"It may not be possible to design an apparatus to meet all of these conditions, but, if for a moment we neglect the introduction of the liquid from above the fabric, there are in existence a number of designs which may be considered, or possibly modified, to measure absorbency rates. The mechanisms involved within the fabric when the liquid is introduced, first, at one point, and, second, over the entire area of fabric. are in the first instance largely capillary attraction along the two principal axes of the fabric, and in the second instance essentially imbibing liquid through the fabric from the one side to the other.

"An apparatus which generally tests the first situation is that described by Hollies, Kaessinger, Whatson, and Bogaty. A modification of this apparatus was also described by one of the Committee members utilizing an electronic strain gauge, amplifier, and a recorder. (The strain-gauge system in either an Instron or Thwing-Albert testers may be used.) The second situation—imbibing the liquid through the fabric—may be tested by an instrument similar to that designed and constructed by the previous Water Absorption Committee but it is the opinion of the present committee that much improvement is needed in this apparatus.

"Another type of test under consideration by the Committee is one which determines total capacity only. This instrument consists of a sensitive weighing device, preferably a recording balance or strain gauge, on which fabric saturated with the fluid under investigation is weighed against time. As the test progresses, the first noticeable effect is a rapid decrease in weight as excess water drips out of the fabric. The second phase of the test is slower loss in weight due to evaporation of water from the interstices of the fabric, followed by a third phase at a still slower rate consisting of water migration from the

inner portion of fabric to the outside.

"By extrapolating the second phase, which is linear, back to zero time it is possible to estimate the total capacity of the fabric. It has been found that, in order to obtain reproducible results, the humidity and temperature of the room in which the sample is exposed must be constant and there should be uniform air motion.

"While the factors involved in the measurement of water absorbency of textile materials may be many and varied, it is evident from the foregoing discussion that there are three factors which the Committee considers of primary importance. These are:

1) Saturation Capacity.
2) Axial Absorption Rate (Absorption rate of liquid along the two major axes of the fabric.)
3) Transfabric Absorption Rate (The absorption rate of liquid through the fabric).

"At the present time the Committee is reviewing and evaluating methods to measure each of these factors."

COMMITTEE RA60, COLORFASTNESS TO WASHING

Virgil D Lyon, chairman, reported the following:

"The Committee is in the final stages of preparation for an interlaboratory survey to determine if our present accelerated tests cover all levels of washability. Since the IA test was only recently adopted and the IVA test was reviewed during the past year, the Committee had previously restricted the current study to fabrics in the IIA and IIIA levels. There have been no significant changes in commercial laundry practices since these tests were established and the work will be further restricted to home-type washing machines.

"A steering committee met in February and adopted a proposed program for the survey. At our meeting this morning, the program was discussed in detail. Suggested alterations will be incorporated into the program and given final approval at our next meeting.

"We are now collecting fabrics for the program which will include both dyeings and prints on 100% fiber compositions in addition to all the popular fiber blends that can be obtained. It is also hoped that these dyeings will represent all of the dye classes. Although the identification of the individual dyes employed is not essential, it is hoped that concerns supplying the fabrics will identify the class of dyes used and on blend fabrics, the class on each fiber.

"The washing tests will be done by the participating laboratories in home-type washing machines. Both tumble- and agitator-type machines will be employed."

COMMITTEE RA33, COLORFASTNESS OF TEXTILES TO ATMOSPHERIC CONTAMINANTS

V S Salvin, chairman, presented the following report:

"The following proposals as to the project for Exposure of Dyed Fabrics to Atmospheric Conditions has been made up as requested by the Committee. The Committee has been granted the sum of $600 for preparation of the dyed fabrics and for the exposure of those fabrics out of contact with light in several areas. The objective is to determine whether fading takes place for reasons other than chemical action of light. The Committee is aware of the anomalous results obtained on sunlight exposure in Florida and in Arizona. There has already been indicated preliminary results on the exposure of dyed fabrics of various types in California.

I) FIBERS——cotton, wool, nylon, acrylic, acetate and polyester

II) DYE CLASSES——
- on cotton—fiber-reactive dyes, directs, vats, sulfurs, and naphthol dyes
- on wool—acid and neutral-premetalized dyes
- on nylon—disperse, neutral-premetalized and acid dyes
- on acrylic—disperse and cationic dyes
- on acetate — disperse including anthraquinone and azo-type dyes
- on polyester—disperse including anthraquinone and azo-type dyes

III) SELECTION OF SPECIFIC DYES——It will be noted that contact is being made not only with fiber producers but also those of the Lightfastness Committee who have had prior experience in anomalous fading results. We are also sending letters to a number of people who have had long experience in the dyeing of wool and cotton with the request herein that they suggest specific dyes or types whose fading results would be pertinent.

IV) PREPARATION OF DYED FABRICS——It is proposed that a Task Force be set up among the members of the Committee and with the cooperation of dye suppliers and fiber producers for the dyeing on a laboratory basis of 50-gram swatches of the selected dyes on the specific fibers at a level of medium shade. The depth of shade should not be so heavy as to make changes difficult to observe.

V) EXPOSURE —— Exposures would be in Florida, Arizona, in California and possibly in an industrial area, such as New Jersey. The exposure would be in a box open to the atmosphere but not exposed to sunlight. Exposure time would be for a time of one month and for three months. We would suggest that the exposure sites used by the Lightfastness Committee be used and that exposure boxes be constructed under the direction of an AATCC Research Group.

VI) EVALUATION——No prediction can be made as to what results will be obtained since the objective is to establish and confirm changes which have been unofficially noted and which have been puzzling from time to time as communicated by dye manufacturers and fiber producers. It may be subsequently necessary to use laboratory procedures such as gas-fading tests, ozone-fading tests, light-fading Fade-Ometer exposures, and possibly the use of a gas-fading chamber with atmospheric gases, such as sulfur dioxide, and combustion products, as gasoline, etc, in order to finally set up any test procedure.

"We would welcome suggestions for implementing the above proposal as well as any offers to help by interested parties."

COMMITTEE RA34, BLEACHING

B K Easton, chairman, reported as follows:

"The following items were taken up at the meeting of the Bleaching Committee on April 21, 1961.

"Tentative test method #79-1954, Determining the Absorbency of Bleached Woven Cotton Cloth, was discussed. During the discussion, J N Sivertson, chairman of the Commit-

tee on Water Absorbency, gave a brief of its approach to this subject. It was decided by the Bleaching Committee to maintain the present test as a tentative method, to continue our close cooperation with the Committee on Water Absorbency, and to initiate further studies to check the reliability of the present test method.

"Tentative test method #81-1954, Determining the pH of Water Extracted from Bleached Woven Cotton Cloth, was discussed. Tests carried on in one of our laboratories indicated that this method has a good measure of reliability. The Committee voted unanimously to recommend to TCR that this test be made permanent.

"A discussion on a procedure titled 'Determination of Hydrogen Peroxide in Bleach Bath' was held. It was pointed out that this test method was accepted by TCR in 1957 and published in the *American Dyestuff Reporter* in June of 1957. To date it has not appeared in the *Technical Manual* and questions were asked regarding this fact. We understand now that it is being held to appear in the revised monograph, 'Analytical Methods for a Textile Laboratory,' which is being prepared. The Committee noted that similar procedures are published in the *Technical Manual* and inquiries have been received by various members from the industry regarding this particular procedure. Therefore, the Committee requests that this procedure be published annually in the *Technical Manual*.

"A new test procedure to replace standard test method #29-1957, Colorfastness to Peroxide Bleaching, was submitted to TCR in early 1959. To date, no action has been taken on this method. The Committee respectfully requests that TCR initiate appropriate action on this method.

"The Committee is continuing its efforts to devise a method for the determination of whiteness of textile materials. New enamel standards have been supplied and special cloth samples are being prepared. All these will be circulated to the Committee for interlaboratory study to be reported on at a later date."

A motion was made and seconded that the recommendations of Committee RA34 be accepted. The motion was adopted.

COMMITTEE RA31, ANTIBACTERIAL AGENTS

Ethel McNeil, chairman, submitted the following report:

"The Antibacterial Agents Committee has carried out three series of interlaboratory tests on the quantitative test procedure since the progress report of May, 1960. Three technical problems received especial attention.

"The size of the inoculum has been agreed upon and most participants have been able to standardize their cultures.

"The total volume of liquid in which the bacteria used for the inoculum are suspended is important. Too small a volume results in drying during incubation, and too large a volume results in excess free liquid. A comparison of the use of two volumes was made in the last series of tests.

"The choice of a method of application of the inoculum which will insure even distribution on the fabric has been discussed at several meetings. There appears to be general agreement that it can be satisfactorily accomplished with a pipette. Another part of this problem has been the size of the swatch or swatches.

"At the October, 1960 meeting in Philadelphia, it was suggested that the Committee might recommend acceptance of a two-part test procedure as follows: 1) a qualitative or presumptive test, and 2) a quantitative or reference test. The chairman suggested that she send out questionnaires to the Committee members to obtain an expression of opinion. The results of the questionnaire were discussed at the January, 1961 meeting. The membership was about evenly divided as to willingness to recommend a two-part test procedure. However, only two members felt that a presumptive or qualitative test alone was sufficient. It was generally agreed that the Committee would concentrate on completing the development of a workable, quantitative test procedure.

"In the near future the chairman plans to circulate a draft of the procedure for approval by the Committee members."

COMMITTEE RA23, COLORFASTNESS TO WATER

The following report was submitted by G J Greendonner Jr, chairman:

"At our meeting on March 21, 1961, we evaluated the results of our interlaboratory tests, subjecting our recently adopted temporary chlorinated-swimming-pool-water test control standards to four-hour immersion tests, varying the pH.

"Results were close enough for the Committee to accept these three dyes as suitable for use in control dyeings. It was noted that the lower pH (5) gave us a greater shade alteration.

"As a continuation of our study, we will compare the four-hour immersion test with the present AATCC standard test method."

APPOINTMENTS TO RESEARCH COMMITTEES

The following appointments to research committees were confirmed by ECR on March 17, 1961:

Alice G Balfrey, Deering-Milliken Research Corp, to Committee RA56 (Evaluation of Finishes for Resistance to Staining and Soiling).

Alfred T Clifford, Riegel Textile Corp, to Committee RA31 (Antibacterial Agents).

Edward J Elliott, FMC Corp, to Committee RA34 (Bleaching).

Roland Ferron, United Dyeing & Finishing Co, to Committee RA42 (Dimensional Changes in Textile Fabrics).

Floyd H Foster, Conmar Products Corp, to Committee RA60 (Colorfastness to Washing).

Robert F Hoban, Sandoz, Inc, to Committee RA36 (Color).

John W Lane, Atlas Electric Devices Co, to Committee RA35 (Damage Caused by Retained Chlorine).

George D Maynard, Refined Products Co, to Committees RA42 (Dimensional Changes in Textile Fabrics and RA61 (Wash and Wear).

Otto A Ofjord, E I duPont de Nemours & Co, Inc, to Committee RA50 (Colorfastness to Light).

James F Patton Jr, Cone Mills Corp, to Committee RA45 (Identification of Finishes on Textiles).

Herbert Phillips, Philco Corp, to Committee RA61 (Wash and Wear).

Norman G Roth, Whirlpool Corp, to Committee RA31 (Antibacterial Agents).

Jerome B Schapiro, Dixo Co, to Committee RA43 (Drycleaning Test Methods).

Genevieve M Smith, Sears, Roebuck & Co, to Committee RA61 (Wash and Wear).

Paul L Weinle, Celanese Fibers Co, to Committee RA64 (Weathering of Textiles).

Ernest L Wright, Dan River Mills, Inc, to Committee RA63 (Water Resistance of Fabrics).

Research Committee chairmen appointed were as follows:

Hugh R Davidson, Davidson & Hemmendinger, chairman, Committee RA36 (Color).

R & E Command, chairman, Committee RA56 (Evaluation of Finishes for Resistance to Staining and Soiling).

Bernard K Easton, FMC Corp, chairman, Committee RA34 (Bleaching).

Edgar J Page, Belding Corticelli, chairman, Committee RA51 (Nonwoven Fabrics).

George A Slowinske, E I duPont de Nemours & Co, Inc, chairman, Committee RA63 (Water Resistance of Fabrics).

P J Wood, Royce Chemical Co, chairman, Committee RA30 (Analytical Methods).

NEW BUSINESS

Referring to a news article which appeared in the April 5, 1961 issue of *Daily News Record*, A E Johnson briefly reviewed his proposal that steps be taken to classify textiles according to their ability to withstand the damaging effects of sunlight. Mr Johnson requested that the problem of degradation of fibers in sunlight be assigned to an existing research committee or that a new committee be formed with the ultimate objective of developing a sunlight-damage test. At the suggestion of Mr Sylvester, Mr Fortess stated that this request would be presented to the Executive Committee on Research for consideration at its next meeting.

ADJOURNMENT

There being no further business, the meeting was adjourned at 3:55 pm.

Respectfully submitted,
G J MANDIKOS, *Secretary*
Technical Committee on Research

Membership Applications

October 5-11, 1961

NEW ENGLAND REGION

Northern New England Section

Senior

Alvin O Ramsley — Supervisory chemist, QM Res & Engr Command, QM Res & Engr Center, Natick, Mass. Sponsors: F J Rizzo, A M Campbell.

Transfer to Senior

Edward E Richard—Plant chemist, Mansfield Bleachery, Mansfield, Mass. Sponsors: E J McNamara Sr, L W Bignell.

CENTRAL ATLANTIC REGION

Hudson-Mohawk Section

Senior

Robert A McWilliams—Associate prof of textiles, State University of NY, College of Education, Oswego, NY. Sponsors: A Cassetta, F J Szurek.

SOUTHERN REGION

Northern Piedmont Section

Senior

Cecil Brenner—Group leader, fiber characterization, Chemstrand Research Center Inc, Durham, NC. Sponsors: E R Kaswell, D H Powers.

Garland E Earhart—Hosiery dyer, Acme Hosiery Dye Works Inc, Pulaski, Va. Sponsors: C H Schuettler, A T Glenn.

Reginald B Gillespie—Overseer of beam & pkg dyehouse, Dan River Mills Inc, Danville, Va. Sponsors: J T Gillespie, C L Zimmerman.

Byron H McNeil—Overseer of finishing, Hannah Pickett Plant, J P Stevens & Co, Inc, Rockingham, NC. Sponsors: G W Spicer, J E Cummings.

Allan C Spearman—Asst overseer of finishing, Hannah Pickett Plant, J P Stevens & Co, Inc, Rockingham, NC. Sponsors: G W Spicer, J E Cummings.

Piedmont Section

Senior

Dan C Amick—Overseer finishing, Burlington Ind, Altavista Fiberglass Fin Plant, Altavista, Va. Sponsors: A H Gaede, E J Jardis.

Southeastern Section

Senior

Alex A Scarborough—Chief chemist, research chemist, Research Dept, Callaway Mills, LaGrange, Ga. Sponsors: D T Thompson, G P Paine.

South Central Section

Senior

Lewis S Rubin—Dyer, Werthan Textile Mills, Nashville, Tenn. Sponsors: H J Crail, N J Holmes

Transfer to Senior

David F Smith—Supt of dyeing and blending, Burlington Industries, Peerless Woolen Mills, Rossville, Ga. Sponsors: P O Anderson, H C Bridges.

Washington Section

Transfer to Senior

Edith Maier Singh—Textile chemist, Union Carbide Chemicals Co, S Charleston, W Va. Sponsors: R G Curtis, T H Newman.

Transfer to Junior

Ted E Hager—Research chemist, Hercules Powder Co, Covington, Va. Sponsors: W C Walter Jr, G J Mandikos.

WESTERN REGION

Mid-West Section

Senior

William A Holland—Chief chemist, Helene Curtis Industries Inc, Chicago, Ill. Sponsors: G P Paine, G J Mandikos.

Junior

Donald J Bannon—Dyer, redyeing plant, General Rug Co, Chicago, Ill. Sponsors: W H Sites, W Boyd.

Pacific Southwest Section

Transfer to Senior

Joseph Rothway—Head dyer, Imperial Rug Mills Inc, Oakland, Calif. Sponsors: J R Savnik, R W Sumers.

STUDENT CHAPTERS

Bradford Durfee College of Technology

Student

Leonard M Ansin—Student, Bradford Durfee College of Technology, Fall River, Mass. Sponsor: C E Medde.

Kenneth D Langley — Student, Bradford Durfee College of Technology, Fall River, Mass. Sponsor: C E Medde.

Clemson College

Roy E Phillips—Student, Clemson College, Clemson, SC. Sponsor: J Lindsay.

Jerry N Pruitt—Student, Clemson College, Clemson, SC. Sponsor: J Lindsay.

Lowell Technological Institute

Manikant R Shah—Student, Lowell Technological Institute, Lowell, Mass. Sponsor: G R Griffin.

Activities of the Local Sections

Metropolitan

THE November meeting of the Metropolitan Section will consist of a discussion of textile chemicals by three speakers from the Shell Chemical Co, Union, NJ, and a visit to the Company's laboratories. Dinner will be served at the Suburban Golf Club.

A social hour will begin at 6 pm and dinner will be served at 7 pm. Cost of the dinner will be $6.35, choice of minute steak or swordfish.

At 8 pm, those in attendance will be divided into two groups, one group to hear the lectures and the other to be given a conducted tour of the Shell Laboratories. Transportation will be provided from the Surburban Golf Club and back. At 9:15 the two groups will interchange and the lectures and the tour will be repeated.

Attendance at the meeting will be limited to 200. Reservations may be made with Eugene Grady, Metropolitan Section treasurer.

The laboratory tour will include a visit to the following units: agricultural chemicals display, demonstration of fluidized bed apparatus, demonstration of the gas-liquid chromatography unit, textile display, demonstration of Epon-Foam resins, display of optical and electron microscopes, display of radiochemistry equipment.

The lectures will include the following: " Laboratory Evaluation of New Creaseproofing Agents Using Statistical Techniques" by G R Ferrante; "Effect of Alternate Desizing Techniques on Properties of Various Fabrics" by H W Eastwood; "Radiotracer Methods in the Textile Industry" by R E Murdock.

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Richard E Rettew, outgoing chairman, Palmetto Section

Palmetto

(Submitted by E Thomas McIlwain, secretary, Sept 21, 1961)

THE Palmetto Section completed its first year with a business meeting at the Clemson House, Clemson, SC, on September 16. New officers for 1962 have been announced as follows:

Chairman—Neal A Truslow

Vice Chairman—E Thomas McIlwain

Secretary—Joseph H O'Neill

Treasurer—William E Baldwin

Councilors— J C King, Richard E Rettew, Linton C Reynolds

Sectional Committee—Wilbur J Hammett, Edward H Giard, Jack H Emerson, Leonard A Stanley.

Gertrude A Lathrop, Old Fort Finishing Plant, chairman of the Section's Research Committee, conducted a well-attended research meeting.

D Ray Lassiter, National Starch & Chemical Corp, spoke on "Cross-linked Resins for Textile Finishing" and John McPhee, research chemist, CSIRO, Division of Textile Industry, Geelong, Australia, spoke on "Modern Finishing for Wool."

Guest speaker at the dinner session was Arthur Erwin, executive secretary, Spartanburg Development Association.

D Ray Lassiter

John McPhee

Below: Two random photos taken at Palmetto Section meeting of September 16

Howard Edwards, Bibb Mfg Co

Fernand Schlaeppi, Ciba Co, Inc

Cecil Ray, Pepperell Mfg Co

Southeastern

(Submitted by Richard M Jones, secretary, October 6, 1961)

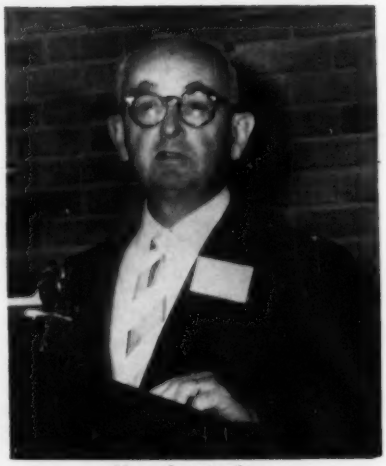
A "back to school" meeting of the Southeastern Section was held at Ida Cason Callaway Gardens at Pine Mountain, Ga, Sept 9, 1961. 190 members, wives, and guests were in attendance.

Howard Edwards, Bibb Mfg Co, was the sectional committeeman in charge of the meeting, the theme of which was "Fiber-Reactive Dyes". The morning session included short, formal presentations by Fernand Schlaeppi, Ciba Co, Inc; Raymond Thornton, Arnold, Hoffman & Co, Inc; and Hans Luttringhaus, Carbic-Hoechst Corp.

Mr Schlaeppi talked about monochloride-triasynil, or Cibacron reactive dyes, and pointed out some newer developments. The new Cibacron P series dyes, due to their low affinity, are highly suitable to padding and printing; while a new copper phthalocyanine derivative, Brill Blue C4GP, has extremely high lightfastness and is not phototropic.

Dr Luttringhaus exhibited a number of successful mill dyeings for which fiber-reactive dyes were proved to be acceptable. The Remazol dyes can be used in piece-goods dyeing by the chemical-pad-steam method, jig dyeing, beck dyeing and dyeing and simultaneous resin treatment and printing.

Mr Thornton stated that Arnold Hoffman makes two distinct types of Procion dyes, one very reactive, which is capable of dyeing cotton at room temperature, and the other less reactive, and, therefore, preferably applied at higher temperatures. Conventional dyeing equipment and conventional dyeing methods can be used, but of special interest is the method of padding with the reactive in presence of soda ash, allowing goods to lay batched two to four hours during which time level, well-penetrated dyeing can be obtained.



Hans Luttringhaus, Carbic Hoechst Corp

Raymond Thornton, Arnold, Hoffman & Co, Inc

A roundtable discussion, moderated by Cecil Ray and highlighted by spirited exchanges of ideas, held the attention of the group during the afternoon session.

A pleasant social hour and buffet banquet brought to a close this annual fall meeting.

•

South Central

(Submitted by Betty M Ellis, secretary, September 20, 1961)

THE South Central Section met on September 16, 1961 at the Lakeshore Lodge, Chickamauga Lake, with approximately 90 persons in attendance. Harry Rowden, General Dyestuff Co, was in charge of the meeting.

The afternoon technical sessions were of the open-forum type on the following subjects:

1) *Package dyeing*—Jim Turner, Dixie Mercerizing Co, moderator, assisted by Bill Bass, Standard-Coosa-Thatcher.

2) *Bleaching, dyeing and finishing of cotton (hosiery, knit, etc)*—John Sweitzer, Scholler Bros, moderator.

3) *Bleaching, dyeing and finishing of woolen yarn, tufted fabrics and carpet fabrics*

4) *Bleaching, dyeing and finishing of cotton piece goods*—Howard Loveless, Crystal Springs Bleachery, moderator.

Following the technical sessions, a social hour was handled by Jesse Roberts, General Aniline & Film Corp. A smorgasbord buffet concluded the meeting.

The following slate of officers was named for 1962:

Chairman—Lowell Shive, Arnold, Hoffman & Co, Inc

Vice Chairman—Jack Welborn, Riegel Textile Corp

Secretary—Arthur Williams, E I duPont de Nemours & Co, Inc

Treasurer—Robert Ingram, Lebanon Woolen Mills

Councilors — Charles Braswell, Seydel-Woolley & Co; E V Helms, Geigy Dyestuffs

Sectional Committee—Paul Anderson, Peerless Inc (two years); Glenn P Martin, Tennessee Tufting Co (two years); Jim Turner, Dixie Mercerizing Co (one year); Harry Rowden, General Dyestuff Co (one year).

Western New England

(Submitted by W H Espelin, secretary)

The September 15 meeting of the Western New England Section featured an afternoon visitation to the Research Laboratories of the American Cyanamid Co at Stamford, Conn. Visitors were welcomed by George Royer, 1950 Olney Medalist.

After the visitation, the group adjourned to Hugo's Restaurant in Stamford for dinner. Chairman Al Rant introduced the speaker of the evening, Jason Salsbury, director of research, American Cyanamid Co, who discussed "Present and Future Man-made Fibers".

The chairman led a discussion on a possible New England Regional meeting in 1962, and appointed the following committee, which is to meet with similar committees from the other New England Sections: Al Marquis, Al DeCesare, and Art Merritt.

Jason Salsbury, American Cyanamid Co

Attendance at the meeting was 65.

PHOTOS TAKEN AT WESTERN NEW ENGLAND SECTION MEETING OF SEPTEMBER 15, 1961

Head table, l to r: W H Kieffer, American Cyanamid Co; Jason Salsbury, American Cyanamid Co, speaker; Albert Rant, Laurel Soap Mfg Co, chairman; Timothy Horan, vice chairman, Princeton Mills; Thomas Gillick, American Felt Co, national councilor

Rhode Island

(Submitted in part by R V Dugdale, secretary, September 22, 1961)

THE Rhode Island Section held its Management Meeting Friday, September 15, at the Wannamoisett Country Club, East Providence, RI, with approximately 88 people in attendance.

Clement Williamson, president of Sealol Corp, spoke on "The Impact of the Weekpaug Group on the Contemporary Rhode Island Scene".

Mr Williamson, who is first chairman of the Weekpaug Group, described its history and purpose, and evaluated the effect and influence of business climate seminars on the proposed legislation of the last Rhode Island General Assembly. He also discussed the events leading up to defeat of the personal income tax in Rhode Island.

The Weekpaug Group is well known in Rhode Island for its spread of business climate seminars and subcommittees which are trying to stimulate and further the interest of all the citizens toward a more active participation in the party of their choice which should lead toward a more prosperous Rhode Island.

•

Hudson-Mohawk

(Submitted by Anthony Cassetta, secretary, October 17, 1961)

THE Hudson-Mohawk Section held its first technical meeting of the '61-'62 season in the form of a plant tour at the General Aniline & Film Corp, Rensselaer, NY, on October 13. In attendance for the tour were 90 members and guests.

Following the plant tour the group enjoyed a social hour courtesy of General Aniline & Film Corp.

Dinner was served in the plant cafeteria and a short business meeting was held, during which Irwin Smith III was elected councilor for the Section.

John C Lawler, manager of the Dyestuff Manufacturing Division of General Dyestuff Co, addressed the group. Dr Lawler's talk was based on the company's historical background and through the use of colored slides he summarized the tour and the plant operation. A question-and-answer period followed Dr Lawler's presentation.

PHOTOS TAKEN AT RHODE ISLAND SECTION MEETING OF SEPTEMBER 15, 1961

(Photo by Everett)

Group at Management Meeting—l to r: W George Parks, AATCC vice president, New England Region; John J Roarke, chairman, R I Section; Frank H Casey; Clement W Williamson, speaker; Alan Howland; Thomas Wright; Charles Robinson

(Photo by Everett)

Clement W Williamson, speaker, answers questions

(Photo by Everett)

Al Howland, Original Bradford Soap Co; Derek Oakes, Arnold, Hoffman & Co, Inc; Jim Davies, Arnold, Hoffman & Co, Inc

(Photo by Everett)

Clement W Williamson, speaker, discusses other phases of Rhode Island problems with group

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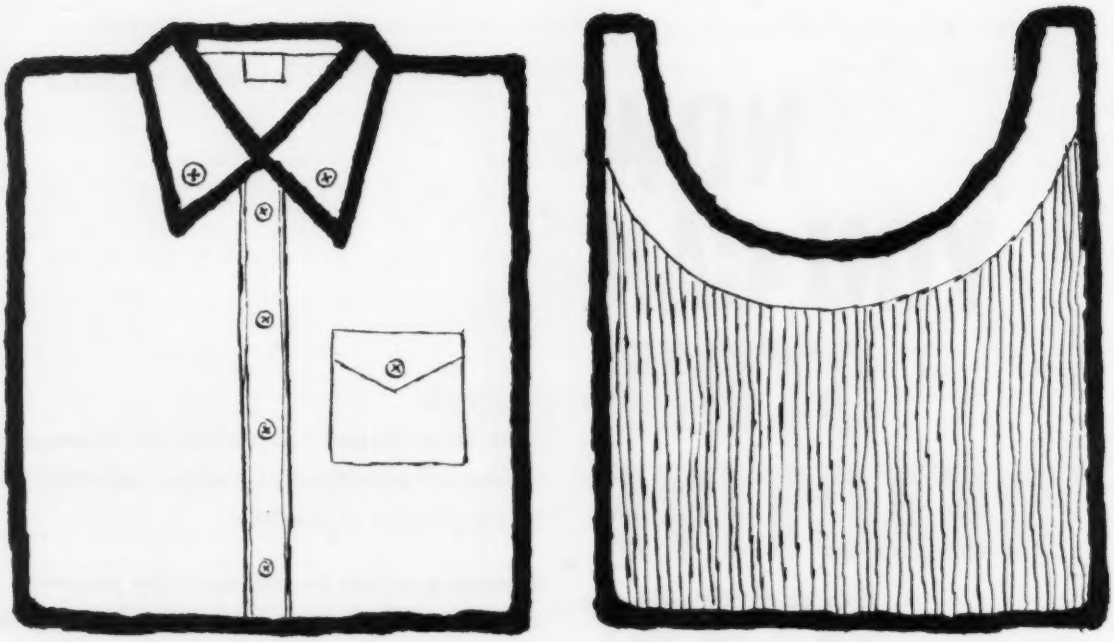

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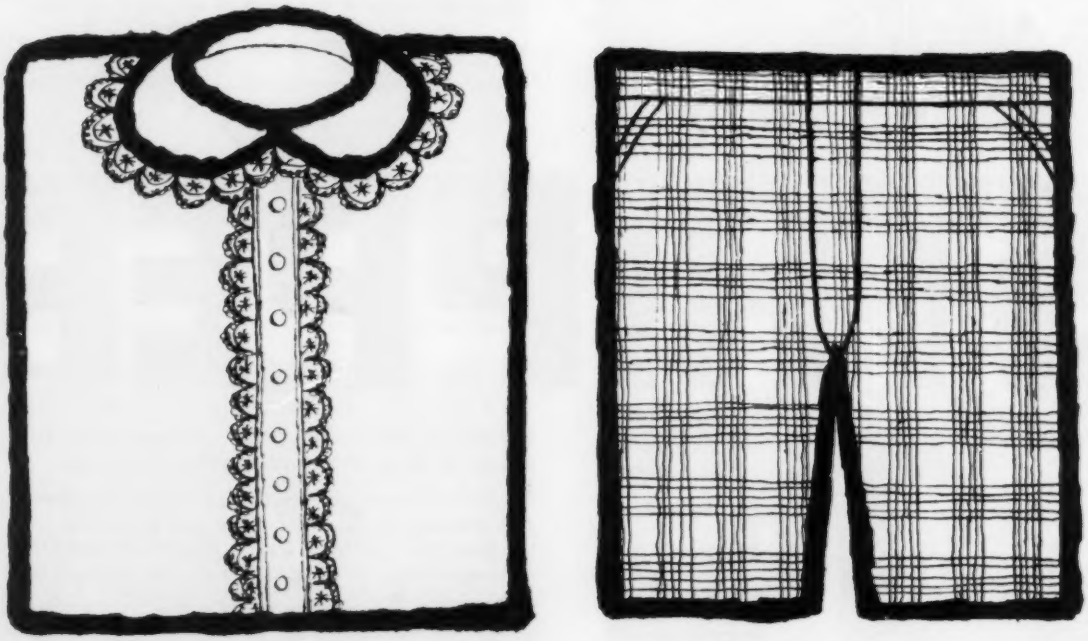

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ADR News Report:

General News of the Industry
Personalities in the News
New Products, Developments, Processes

Investornews: "Textile Industry's Future Has Strong Financial Fiber

The textile industry is beginning a recovery which should return textile manufacturers to healthier profit levels and which promises to usher in an era of relative stability in profit margins and new profit growth.

That's the report of *Investornews*, a financial magazine published by Francis I duPont & Co, nation-wide security and commodity brokerage firm, in an extensive appraisal of the textile industry appearing in the October issue.

Few in the industry believe they have all their problems licked, but at least they are about convinced that they are learning to live with them. Overcapacity and slack demand, imports, and new synthetic fibers are cited as the major reasons for past weaknesses in the industry's financial fiber.

However, one of the most painful of the postwar problems—overcapacity—they hope has been pretty well plowed under. Estimates of excess capacity are now "under 15%" as against "over 30%" a few years ago.

Unfilled order totals are mounting, and prices show signs of firming. Demand is due for a spurt thanks to the 20% population increase projected for the Sixties. Final quarter profits in 1961 should show a steep climb and this momentum is expected to last at least well into 1962, with results matching and even surpassing the relatively prosperous totals of 1959 and 1960, *Investornews* reports.

The industry had been racked by implosions of new synthetic fibers which dislocated existing markets for cotton, wool, and the older synthetic, rayon. Serious shifts disturbed the structure of the industry. For instance, nylon and other synthetics, which accounted for less than 1.1% in 1947, loomed large enough to claim 12.7% of the market in 1960, causing textile manufacturers to find themselves tangled in a skein of snarled prices. But the industry has emerged stronger after a wave of mergers and expansion which brought both higher degrees of vertical integration and some opportunities for diversification. Burlington moved into the carpet business with the acquisition of James Lees. And United Merchants and Manufacturers has moved into chemicals and plastics—to cite just a few exmples. Lowenstein, J P Stevens and Dan River Mills have set up factoring subsidiaries which turn a nice profit through financing trade accounts receivable for the industry.

There is still one deadly serious controversy which overhangs the industry—the import question. Reports the Francis I duPont & Co publication: all but the staunchest protectionists have been somewhat heartened by official government reaction. The Administration last May presented a seven-point program aimed at helping the industry help itself. Some of the points under study: possible liberalization of depreciation allowances; financial aids for smaller members of the industry; projected conferences of major textile nations to try for an agreement on voluntary limits on exports to participating nations. Action has already been taken on the latter by representatives of 16 major cotton textile producing countries.

Meantime, U S manufacturers are quickly following a new trend—establishment of joint ventures with leading foreign firms to manufacture textiles abroad. This, with the prospect for increased domestic consumption and reinforced industry structure, give the long-term outlook a definite growth pattern, the publication states.

●

Stevens Forms New Chemical Sales Dept

Paul B Stem, director of research of J P Stevens & Co, Inc, announced October 18 the formation of a new Chemical Sales Department, with headquarters in Greensboro, NC.

He also made known the appointment of John R Poer as sales manager of the newly created Department. Mr Poer, who will be responsible for sales to the textile trade, will assume his new duties effective immediately, and will make his headquarters in Greensboro. Prior to joining Stevens he was associated with Penick & Ford, where he served as district sales manager, covering the Carolinas.

Bow and Skew Avoided at Arrow Div, Allied Textile Printers, Inc

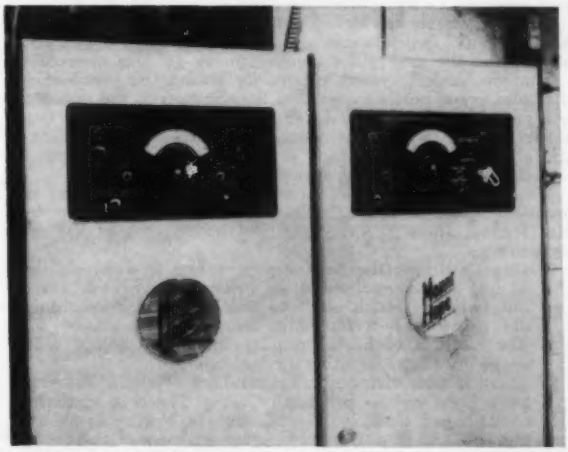
Bowed, skewed and otherwise imperfect cloth is a problem to any printer. In the case of the Arrow Division of Allied Textile Printers, Inc, Paterson, NJ, however, this problem takes on added dimensions. First as a printer of high-quality synthetics and blends for some of the industry's top names, Allied is charged with maintaining highest standards of quality control. It follows also that the problems of re-runs and of imperfect and damaged goods are perhaps more critical than most at Allied because of the nature of the operation and the value of the fabrics.

For years, like most of the industry, Allied tried to solve the problems of web control with visual inspection and various methods of manual manipulation and control of the fabric. Later the company purchased and installed an automatic control device which used a system of reflected light as the sensing mechanism. But, while interesting in theory, the device never could be made to work consistently well on all fabrics since the light-reflecting values of individual fabrics seriously affected the operation of the sensing and correcting mechanism.

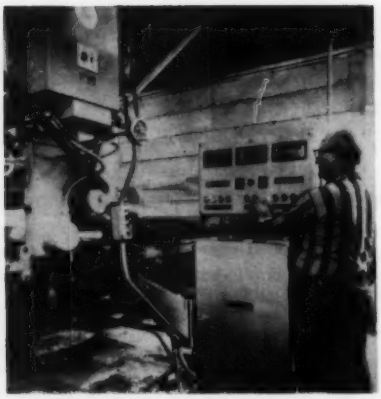
Recently, the Company, under the direction of Chief Engineer L S Granby, decided to put in a new drying range and Mount Hope Machinery Co, Taunton, Mass, was consulted on the weft (or filling) straightening part of the operation.

The assignment handed to Mount Hope was a complicated one. Probably no other finisher runs a greater variety of cloth. In any given day, Allied may be running as many as twenty-five different quality synthetics and synthetic blends —jersey, acetate, cotton and bembergs, sheers, nylons, silks, Dacrons and many more. Because the weave characteristics of these cloths are different, the identification and control factors are not constant. For instance, Mount Hope's automatic filling-straightener control, the Orthomat, is based on optical principles. A beam of light, passing through the cloth detects whether or not the filling threads are running at a right angle to the warp. This detection method worked very well—until a sand crepe was run. Sand crepe is an acetate fabric in which the filler threads are a dobby weave with a starlike figure interwoven. Because of this, the gap between the filling threads is not uniform and therefore neither is the light penetration.

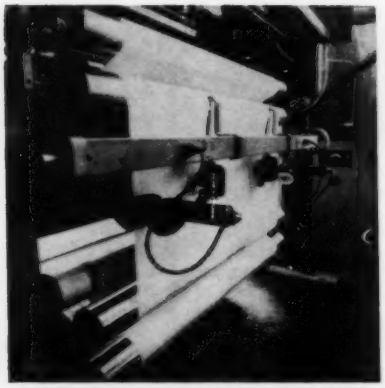
Mount Hope engineers therefore tried their mechanical detection system the Bow Skew Liner, on the sand crepe. The Bow Skew Liner is a detection system based on two pairs of sensing rollers or wheels, each on an independent pivot. The wheels ride on the warp threads. When the



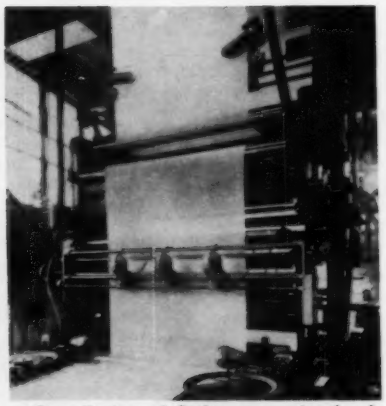
Mount Hope Bow and Skew Liner (electromechanical detection) control. System may be set either for completely automatic or push-button control.



Operator is pressing starting button of Orihoma control. Control is completely automatic.



Mount Hope bow skew liner detector. Sensing wheels will detect bows and skews on complicated weaves like sand crepe, which will not respond uniformly to optical detection.



Overall view of Orthomat sensing heads located close to the tentering frame to assure that cloth fed to the frame is straight and square.

Close-up of the Mount Hope Compak bowed-weft straightener.

threads are straight, the wheels are in line. When the threads become skewed, the wheels are out of alignment. This sends a signal to the control box which in turn operates a pivoting control motor which sets the roll in correct position to straighten the cloth.

All four wheels are locked together to detect a bow. When a bow occurs they assume an angular distortion which also signals for the correction mechanism to go into operation.

The mechanical system reportedly solved the problem of the sand crepe perfectly, so that the solution to the problem became obvious and Allied Textile Printers became the first plant in the world to completely automate its filling-straightening operation with a combination of both optical and mechanical detection systems.

What has this installation meant to Allied in terms of practical management advancement? As summed up by Mr Granby, these are the principal advantages of the installation:

1) One machine (the new drying range into which the Mount Hope equipment is incorporated) now turns out twice as much cloth as two comparable machines did previously—a four-fold increase.
2) The cloth is of higher quality than ever before with no bows, skews or other imperfections.
3) There is now virtually no rehandling of cloth. Re-runs have been cut to practically zero. There is virtually no damaged cloth, no seconds due to bowing or skewing.
4) There is a considerable upgrading of labor. Before, an operator had to be on constant duty with the tedious job of watching the cloth and straightening it by hand when skewed or bowed. Now the operator is freed for more interesting, rewarding work.

Coming from the bleaching operation in trucks the wet cloth travels through Mount Hope selvage uncurlers and precision guiders.

Next the cloth is fed from boxes into the pad. From the the pad it goes through a compensator.

From the compensator, the cloth travels through the precision guiders, which automatically align the selvages, into the Mount Hope Compak combination bow and skew straightener. Taking a signal from either the Orthomat or the Bow Skew Liner (Allied runs each about 50% of the time, the Orthomat generally for delicate fabrics; the Skew Liner for heavier or more complicated fabrics like sand crepe), the skew correction roll pivots to correct either a left or right leading selvage. The bowed filling straightener consists of two bowed rolls which automatically pivot to drop back the bow in the case of a leading bow or to advance the bow in the case of a lagging bow. Next, the fabric is fed to the tenter frame and through the dryer. The photos show the compact nature of the entire installation—also, that for maximum effectiveness there is a minimum distance of only a few feet between the detection systems, correction rolls and tenter frame. Speed through the dryer is generally 90 to 100 yards per minute. Average temperature in the dryer usually runs around 300°F.

After coming out of the dryer, the cloth is wound up on a surface winder after being pulled through the frame by a variable speed draw roll. This roll applies even tension across the width of the fabric to prevent a lagging bow.

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Renovated Du Pont Tech Lab Shown

The Technical Laboratory of Du Pont's Dyes and Chemicals Division, which has been renovated and modernized completely during the past two years at a cost of more than $1,500,000, was shown at Deepwater Point, NJ, on October 8 for the first time to a group of 250 textile industry representatives attending a two-day technical conference at the company's headquarters in nearby Wilmington, Del.

The group, made up chiefly of dyers and finishers and including editors of several textile trade publications, participated in a conference on the dyeing and finishing of Du Pont synthetic fibers, sponsored by the company's Dyes and Chemicals Division and Textile Fibers Department.

The remodeled, forty-one year old technical sales service and development laboratory is a new laboratory on the same site. All that remains of the old buliding are the walls, the interior having been rebuilt entirely and re-equipped. The renovation reportedly provides modern laboratory facilities for application research in the company's original area of dyes and answers the need for long-range research and development of industrial chemicals, many of which have been introduced within the last decade.

The decision to renovate the existing three-story building, located within the company's Chambers Works, was made because of the desirability of keeping the laboratory physically within the plant where it is in contact with the nearby research facilities of the Jackson Laboratory and the extensive technical and engineering services of the plant's production division.

The renovation was carried out step by step to minimize interruption of work on current development and sales service projects. This was possible because the laboratory is divided into separate, self-contained units. First to be completed were a new textile dyes laboratory and a new paper laboratory. This was followed by renovation of the leather laboratory, the pigments and miscellaneous dyes laboratory, the laboratory specializing in textile and nontextile chemicals and finishing agents, quality-control laboratory, and finally the realignment of administrative offices together with conference room.

In addition to the remodeling and rearranging of space for more efficient use, advanced laboratory equipment has been installed in each section. Among the pieces are a tristimulus differential colorimeter and a colorant mixture computer. Another new piece of equipment is a xenon textile dye tester for accelerated light-fading tests to supplement the Fade-Ometer. Technical Laboratory personnel are also able to make use of advanced and specialized equipment available at the Chambers Works, as well as the technical services of other Du Pont groups engaged in related activities, such as the Textile Research Laboratory and Finishes Division.

The Technical Laboratory has a staff of approximately 220 including about 80 who are technical experts in specialized fields of dyes and chemical applications. Out of their work have come a number of new and improved processes including the pad-steam continuous dyeing process, Savagraph printing, Unifog spray, Thermosol, and sponge-core dyeing processes.

Besides research and sales service activities involving work on customers' problems, the laboratory maintains quality control over the plant's dyes and chemicals production, produces all the division's technical literature, and serves as a training center for sales and technical personnel of both the Dyes and Chemicals Division and its customers. Laboratory representatives in an average year reportedly make about 700 trade calls and demonstrations in customer plants.

●

Moretex Develops New Process for Manufacture of Aquazine Softeners

Moretex Chemical Products, Inc, Spartanburg, SC, has announced the development of a new process for the manufacture of the nonyellowing hydrazinium-based textile softeners marketed by Moretex under the registered trade name of Aquazine.

The new process, which reportedly will reduce manufacturing costs by as much as 30%, was developed under the direction of Donald L Davis, plant manager of the company.

Hydrazinium-based softeners, a byproduct of atomic fuel research, were developed and patented by W R Grace & Co. Between 1954 and 1960, W R Grace did considerable work in evaluation of these materials for textile and other uses. In 1960, Moretex obtained an exclusive license for manufacture and sale of these materials to the textile trade and have since been working continuously on both manufacturing and full evaluations.

●

"Wash-and-Wear" Cottons Seen Staging Comeback

Wrinkle-resistant cottons that "really live up to their advertised claims" are expected to put new life this fall in sales of "wash-and-wear" shirts and other similarly treated men's and boys' wear items, a factoring executive says.

"Improved finishing techniques and intensified promotional activities are being counted upon to revive consumer confidence in 'wash-and-wear' cottons," said William A Gray, assistant vice president of Commercial Factors Corporation of New York. "Consumers will find out that the new 'wash-and-wear' fabrics will do everything that is claimed for them."

Technical refinements based on the "cross-linkage" principles of molecular rearrangement of the cotton fiber have resulted in shirtings of superior crease resistance and launderability that "will meet the standards consumers have been educated to expect of wash-and-wear garments," he observed. Popularity of "wash-and-wear" shirts declined noticeably during the past year, largely because of "over-promotion" that had led consumers to expect too much, he added.

"Now that the industry has come up with superior fabrics that can really meet consumers' expectations, the public will have to be educated all over again," Gray said. "Fortunately, some of the best creative talent in the communications profession is working on this assignment. The outlook for 'wash-and-wear' this fall is excellent—not only for dress shirts but also for sport shirts, slacks and other items."

●

Drew Changes Name

E F Drew & Co, Inc, New York, NY, a leading producer of vegetable oil products, announced October 5 a change of name to Drew Chemical Corporation.

According to Lehman Brothers, investment bankers, who, head a controlling group of stockholders in the company, "the change of name reflects the increasing role that the production and sale of a wide range of industrial chemicals plays in the business of the company. The new name is descriptive of the direction of the company's growth and expansion program."

The company also stated it had completed a refunding program involving the conversion of its current bank indebtedness of approximately $11 million to a term basis and that Lehman Brothers had agreed to increase its equity investment by exchanging a current loan for preferred stock.

Drew Chemical Corp was founded in 1907 to engage in the manufacture of imported and domestic vegetable oil products. The company's refinery in Boonton, NJ, with a monthly capacity of 40,000,000 pounds, is the largest vegetable oil refinery in the eastern United States. Among its products are emulsifiers, detergents, fatty acids, derivatives thereof, catalysts and other industrial chemicals.

In addition to the company's principal complex of plants in Boonton, Drew Chemical has refineries in California and Canada, and has wholly owned integrated manufacturing and sales subsidiaries in Brazil and Argentina. The company employs approximately 1,000 people in its plants and offices.

In March of this year, it was announced that a group headed by Lehman Brothers had purchased all of the company's outstanding common stock. Frank J Manheim, a partner of the banking firm, is chairman of the board of directors, which includes other Lehman associates and Henry J MacTavish, chairman of the Executive Committee, and Robert Preusch, chief executive officer of Drew.

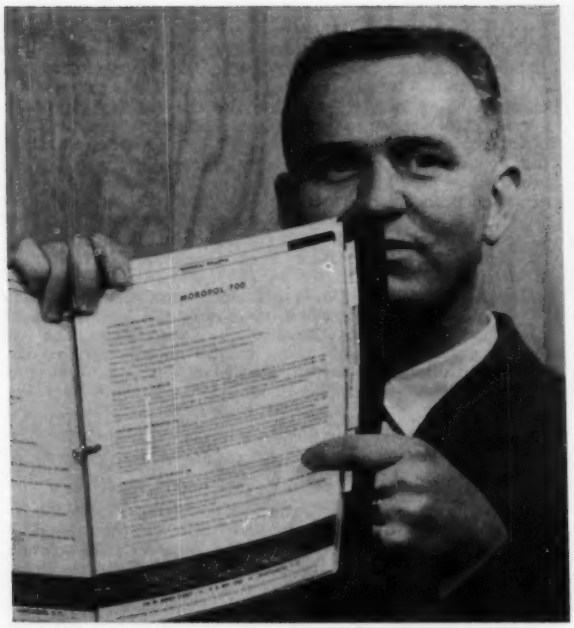
●

Coltar Acquires Detecto Line

Coltar Dyestuff Corp, 369 Greenwich St New York 13, NY, recently completed arrangements with The Harshaw Chemical Co, Hastings-on Hudson, NY, for the acquisition of the latter's Detecto Fugitive color line.

Effective this month, all Detecto colors will be manufactured by Coltar, an affiliate of Rutherford Dye & Chemical Co, Inc, 189 Franklin St, New York 13, NY.

Samples and bulletins may be obtained on request.



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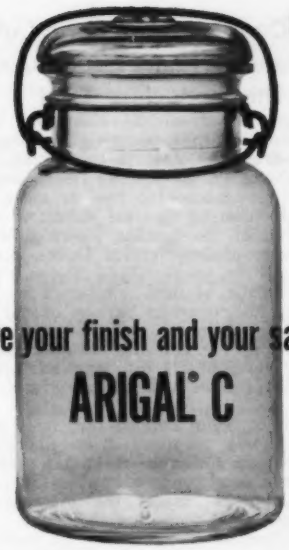

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Clothing of Double-cloth Fabric Construction Said to Enhance Chances for Survival from Thermonuclear Blast

Chances of survival from thermonuclear blast would likely be improved for those wearing clothing of double-cloth fabric construction. And this form of double-cloth clothing (twin fabrics woven together rather than in layers) would offer better resistance to two or more consecutive exposures to high-intensity thermal radiation, according to G T Holmes, head of the textiles, clothing, and footwear division, Directorate of Interservice Development, Ottawa, Canada.

Outlining the results of tests conducted by his department before the 12th Scientific Session of the Institute of Textile Science, Mr Holmes noted that one of the major problems now facing the clothing designer and materials engineer is the development of materials and clothing which would protect man against the effects of thermonuclear weapons.

"While research is being carried out, it is necessary to examine the materials produced from fibers which are currently available in order to meet the immediate requirements. Unfortunately most of these fabrics will only withstand one exposure unless the incident energy to which it is exposed is of very low intensity.

"There is an immediate requirement for materials which are currently available to withstand more than one exposure to a thermal pulse of an intensity which is likely to be met in war under conditions where the man is not likely to be incapacitated by the other effects of a thermonuclear weapon such as transmitted energy gamma radiation, etc" said Mr Holmes.

Canadian tests, he said, had been carried out on single-layer fabrics, using a variety of fibers, both natural and cloth fabrics, fabrics of double-cloth construction, and two-man-made.

Results reportedly showed that both fabrics of double-cloth construction, and two-layer fabrics, offered greater protection, and "it is possible that double-cloth fabric structures could offer better resistance to two or more consecutive exposures to high-intensity thermal radiation, and could also offer improved resistance to other forms of progressive deterioration, such as abrasion, as deterioration would affect one layer at a time."

Chemicolloid to Manufacture Monroe Mixer

Columbian Carbon Co, New York, NY, and Chemicolloid Laboratories, Inc, Garden City Park, NY, have entered into an agreement through which Chemicolloid has obtained manufacturing and sales rights for the carbon company's specially designed apparatus currently in use in their black rubber process. Now known as the Monroe Mixer, the apparatus is said to be ideally suited for continuous pre-mixing and blending of textile coatings and a variety of other process applications. The first public showing of the Chemicolloid-manufactured Monroe Mixer will be at that company's exhibit in the 28th National Exposition of Chemical Industries at the New York Coliseum, November 27 through December 1.

Columbian Carbon Co is a leading producer of carbon black, pigments, dispersions of black and printing inks throughout the world. Chemicolloid Laboratories, Inc has been engaged for many years in the manufacture of the Charlotte Colloid Mill for effecting homogenization and similar operations.

●

AATT Conference Theme Chosen

"The Way to Marketing Profits—Converting Textile Technology into Consumer Satisfaction," will be the theme of the second annual conference of the American Association for Textile Technology on February 7, 1962 at the Hotel Commodore, New York, NY.

In making the announcement, Graham Richardson, E I duPont de Nemours & Co, Inc, general chairman of the conference, indicated that the theme had been selected with a two-fold purpose in mind: to provide textile technicians with better guidance from marketing management based on consumer need; and to better relate the advances in textile technology to marketing management for the benefit of the consumer.

Committee chairmen for the meeting include Arthur Spiro, Waumbec Mills, Inc, technical program; Fred Simmons, Manchester Worsted Mills, treasurer; Walter Scholer, American Viscose Corp, arrangements; Robert Nirenberg, Chemstrand Corp, attendance; Alfred McCullough, *Modern Textiles*, publications, and Robert E Ellsworth, Allied Chemical Corp, publicity.

Abstracts

(*continued from page 22*)

are, however, under development in Italy, Britain and the U S. The first products made by I C I are high-tenacity filament yarns primarily for fish-net twines and ropes.

The action of various chemicals on the polypropylene fiber is shown in a table. The fiber is stable to nitric and hydrochloric acids, caustic soda, sodium hypochlorite, and most drycleaning solvents. Only hydrogen peroxide and boiling solvents are really damaging.

This inertness, coupled with a negligibly small moisture absorption, inevitably makes polypropylene fibers difficult to dye. No one has yet announced the commercial production of a dyeable fiber, the author says, although some pale to medium shades are obtainable with selected disperse dyes. Meanwhile, colored fibers are produced by pigmentation before extrusion of the filaments.

A table of the physical properties of the polypropylene fiber is also included, comparing it with cotton, flax, nylon and Terylene.

Because of its relatively low melting point, the fiber is primarily of interest for fabrics and other materials used at atmospheric temperatures rather than in articles used at high temperatures, eg, tires and belting.

Other uses anticipated are for webbings, tarpaulins, and protective work clothing. The fiber has good abrasion resistance, second only to that of nylon and Terylene. From the point of view of resilience, it is of interest for pile fabrics, eg, carpets and furs. It is also resistant to pilling.

Seven references to the literature are cited.

●

Modern Shrink-resist Finishes for Wool

Davidson, A N, *Dyer* 126, 168-9, August 11, 1961

Although nonfelting wool fabrics have been produced for many years, the author says, "we cannot with any degree of certainty say exactly what chemical changes are required in wool to give a nonfelting finish."

He points out that before considering the chemical processes it is necessary to study the effect of fabric structure on shrinkage.

The original shrink-resist process consisted of the treatment of wool fabrics in an acidified sodium hypochlorite solution. New shrink-resist finishes for wool include the following:

Melafix CH and Melafix II processes. These are modifications of the ordinary wet chlorination technique, synthetic resins being used to combine with the free chlorine, and the halogen being liberated in a controlled manner during the treatment. The resin serves merely as a buffer. An even treatment is achieved in this way.

Dylan Z. Wool materials are treated in a solution containing sodium hypochlorite, potassium permanganate and calcium chloride, to which a wetting agent and other chemicals may be added. The mixed reagents give a stable solution that reacts slowly with

wool materials, thus enabling a level treatment to be obtained. The brown coloration from the permanganate is later removed by bisulfite. The finished wool is said to have a good color and a very soft hand.

Dylanize. The wool is treated with a solution of permonosulfuric acid (Caro's acid) at a pH value of less than 8, followed by treatment with an aqueous solution, or a dispersion, of a salt of sulfurous acid. This process offers the possibility of continuous treatment.

Potassium permanganate in saturated brine. This is a recent Australian development. Wool materials, particularly fabrics, are treated in a saturated (30%) common salt solution containing potassium permanganate. The brown stain is removed by bisulfite.

Peracetic acid and sodium hypochlorite. Wool materials are made shrink-resisting at the W I R A without impairing the wearing properties or the handle by treatment in a dilute solution of peracetic acid, followed by treatment in either a sodium bisulfite solution containing a proteolytic enzyme (papain) or an aqueous chlorine-containing solution. Attention is also directed to the use of a mixed solution containing peracetic acid and sodium hypochlorite. Satisfactory shrink-resistance can be achieved by the use of very small quantities of the reagents, it is said. The wool is later treated with bisulfite. Advantages claimed for this process are high unfeltability, no loss of wool substance, low cost, good color and soft handle, and only slight effect on the shade and washfastness of good dyes.

●

Some Theoretical Considerations of Cellulose Cross-linking

Gardon, J L and Steele, R, *Textile Research J* 31, 160-71, Feb 1961

Much available chemical evidence supports the hypothesis that covalent cross-linking is the best way to improve the resilience of cellulosic fabrics. This paper reviews the theories relating physical properties to cross-linking in rubbery polymers and shows that they apply in some qualitative aspects to cellulose. Particularly, the observed changes in swelling, solubility, modulus, tensile strength and resilience are consistent with these theories.

On the basis of published data, the concentration of intermolecular cross links is estimated; it is found that at least every twenty-fifth accessible anhydroglucose unit in the cellulose molecule has to be intermolecularly cross-linked when maximum crease recovery values are attained. In rubbery polymers, substantial changes in mechanical properties are obtained at much lower levels of cross-linking. This difference between cellulose and rubbers in response to cross-linking is probably due to the polar nature of cellulose.

The authors in conclusion state that cross-linking insolubilizes cellulose and reduces its swelling as in other polymers, but swelling and gelation data on cross-linked cellulose cannot be treated quantitatively to determine cross-link density because the theoretical treatment cannot take into account the nonrandom distribution of cross links which results from the polycrystalline structure of the polymer. The glass transition temperature for cellulose is uncertain, and no information on the effect of cross-linking on it is available.

The dynamic modulus of rayon is first decreased, then increased by cross-linking. The modulus of cotton is unchanged by cross-linking because of its high molecular orientation.

The effect of cross-linking on the tensile strength of cellulose is apparently analogous to the usual effect in other polymers, which shows a maximum as the cross-link density goes up. The maximum is observable in rayon but not in cotton, since the latter is already highly cross-linked in the native state by crystalline regions.

Rayon and cotton celluloses appear to require very high degrees of cross-linking to modify their properties to the point where wash-wear behavior is obtained.

Fifty-two references to the literature are cited.

●

Teflon TFE and FEP: Special Purpose Fibers

Anon, *Man-made Textiles* 37, 44-5, August 1961

Lowest coefficient of friction of any known fiber, exceptionally high chemical stability, and outstanding resistance to deterioration caused by heat are characteristics which make Teflon TFE and FEP fluorocarbon fibers well suited for industrial application.

The TFE fiber, intended for multifilament use, is a tetrafluoroethylene; the FEP fiber, a new monofilament form, is a fluorinated ethylene propylene.

Teflon fibers have a round cross-section and an exceptionally smooth surface. This smoothness, combined with the chemical characteristics of the fluorine atoms which form the sheath of the polymer, gives to Teflon its low coefficient of friction—0.20 dynamic, 0.28 static. The surface is so slippery that no known material can be attached to the fiber with any mechanical strength.

Teflon fibers are the most chemically resistant fibers known. They are completely inert to such reagents as boiling sulfuric acid, fuming nitric acid, aqua regia, and boiling saturated sodium hydroxide. In addition, the usual powerful oxidizing agents have no effect on them. The only known solvents for Teflon are certain perfluorinated organic liquids at temperatures over 570°F. This chemical resistance permits filter cloths of Teflon to be used satisfactorily for a long time in chemical operations where conventional filters cannot be used for long, if at all.

The author cautions that both Teflon fibers at temperatures above 400°F give off toxic vapors which should not be breathed.

Teflon TFE has a mottled brown color which can be bleached by wet oxidation with hot mineral acids. Teflon FEP, however, is colorless, absolutely undyeable, and will not yellow with age or exposure to heat or u v light. The Teflon fibers will not burn.

Due to their unusual frictional behavior, these fibers are used successfully in bearings operating at high temperatures and under heavy loads. Included among the other industrial applications of Teflon TFE are in packings for chemical pump shafts, and in filters for corrosive liquids. Teflon FEP is used for vacuum filters and for bristle brushes used in chemical plants.

●

The Influence of the Newer Fibers on Beam-Dyeing Techniques

Dolby, P J, *Pakistan Textile J* 12, 47-8, March 1961

The author compares beam dyeing and package dyeing techniques, both being very similar insofar as the goods remain stationary while in contact with a circulating dye liquor.

Some of the advantages of circulating-liquor systems include short liquor ratios, high accessibility of the dye liquor, and short dyeing times. In jig dyeing, by comparison, the very low accessibility of the fabric to the dye liquor gives ending difficulties and increases the dyeing time. Dyeing of filament fabrics in winches causes rope marking and cracking.

(*continued on page 62*)

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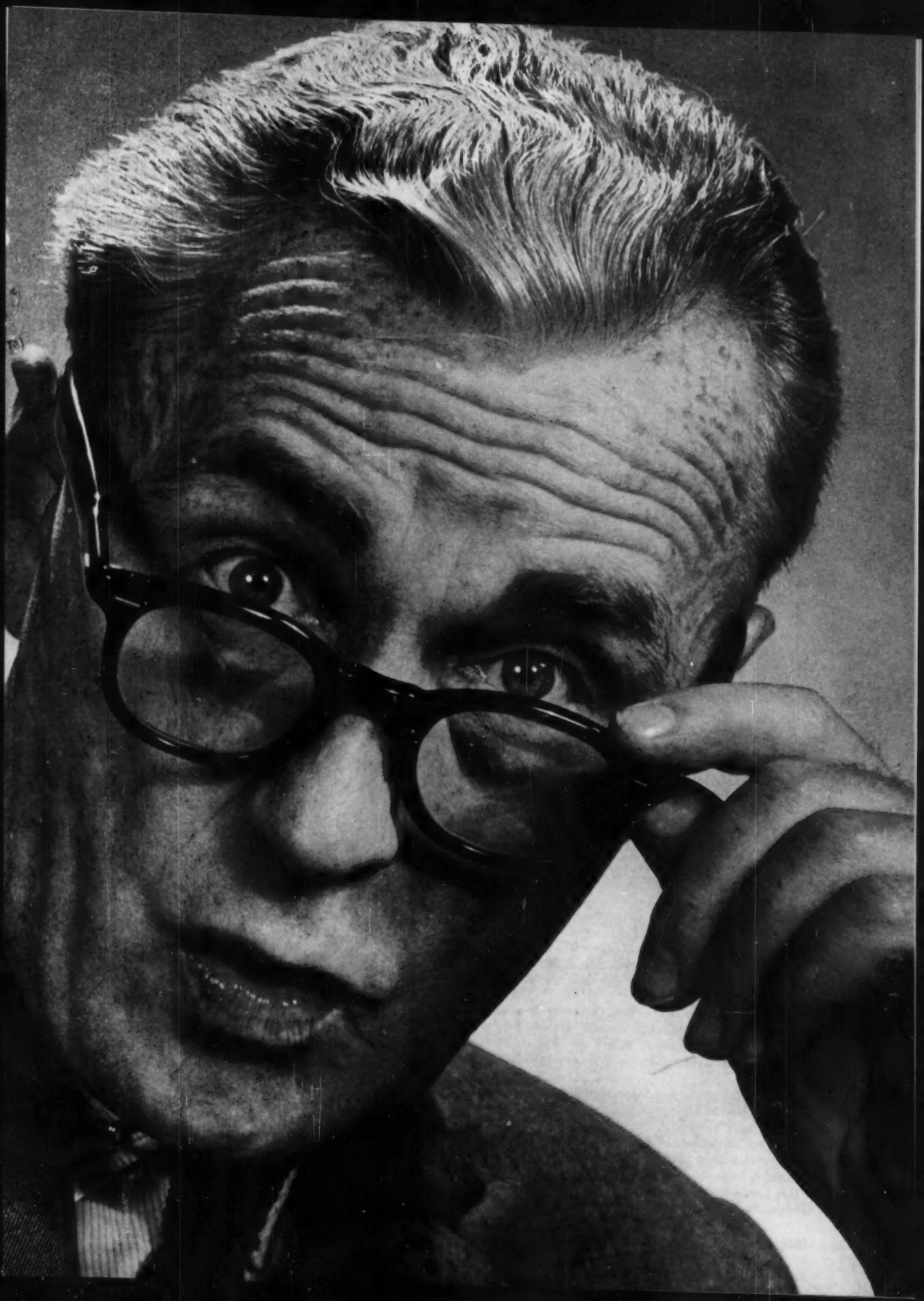

Abstracts———

(*continued from page 59*)

While beam dyeing is by no means a new concept for textile yarns, the technique has only recently become popular for dyeing fabrics. As an example, the "Lancashire" beam for cotton warps has been used for vat-dyeing of cotton knitted fabrics.

The desirability of pressurized equipment suitable for dyeing the newer fibers at high temperatures is mentioned by the author. This is particularly important for Terylene and is becoming more important for other fibers, eg, nylon and cellulose triacetate. Pressurized jigs are said to be extensively used in Japan for dyeing filament polyester fabrics.

Typical horizontal beam machines, and in particular a laboratory beam-dyeing machine used for service work on Terylene, are described.

Single beam machines using "in-to-out" flow are said to be entirely satisfactory for open fabrics such as knitted goods, whereas, for the more closely woven fabrics, reversing the flow direction is recommended, particularly during the "strike" period of dyeing.

The author describes the preparation and loading of the beam, and points out that any shrinkage during dyeing should be minimized; Terylene and nylon fabrics should therefore be set before dyeing.

In dyeing polyester fabrics with disperse dyes in an unpressurized machine, pale shades may be produced without a carrier, but medium to heavy shades require a carrier (eg, Tumescal D). High temperatures, eg, 130°C, are, however, generally preferred to achieve the best leveling. A pH of 5.5 in the dyebath is recommended.

Beam dyeing offers many advantages, according to the author, including increased production due to larger batch sizes, elimination of rope marks, better covering of filament irregularities, and better leveling. The beam dyeing machine, he says, is "very versatile for dyeing and processing all types of fabrics."

•

Woven Stretch

Hamilton, J H, Papers AATT, *Modern Textiles* 42, 57-60, June 1961

"We are on the threshold of a whole new world of fashion *via* stretch." That is the prediction of the author and others who have been associated with the new development of woven stretch textiles.

The author states that mills and technicians in Europe have been working "day and night" for over ten years developing these woven stretch fabrics. It is estimated that they are now consuming from 20% to 40% of the available stretch yarn production. Piece-dyed stretch fabrics have been perfected the longest, but it is stated that yarn-dyed or colored-warp woven stretch fabrics now amount to about one-third of the present stretch weaving production in European countries.

With all of the knowledge that is now available among those groups interested, it should be possible for the US mills to do in a short space of time what it has taken years to accomplish in Europe, the author says.

The building blocks for the successful woven stretch fabric involve the following:

A. The right raw yarn—ie, the new higher elongation nylon in either 70-denier 13 filaments or 70-denier 17 filaments now available from the major nylon suppliers.

B. The right false-twisting. Here the weaver must rely on the knowhow and ability of the throwster.

C. The right post or ply twisting. This is the area where the throwster and weaver must work together in order to achieve the desired modulus, hand, abrasion resistance, and other aspects of fabric performance. Each yarn must be specifically engineered to suit the specific end-usage.

The writer warns that in some cases "bad" stretch fabrics have been and are being marketed in this country today; ie, fabrics which cannot possibly fulfill their requirements. One reason for this is the lack of specific standards as to what constitutes an acceptable stretch fabric.

In Europe the "Helanca" name is widely used on stretch garments and has become symbolic of high quality, the author states.

The better designers in the US realize the tremendous style potential of stretch fabrics, he says, and are "literally begging" for the quality fabrics which will enable them to achieve their goals.

•

Some Developments in Package Dyeing

Gambrell, W H, *Can Textile J* 78, 45-7, May 12, 1961

Dyeing of wool with reactive dyes. The dyebath is first set at 120°F and pH 4.5 with addition of acetic acid, a suitable cationic agent (eg, Tinegal W), and Glauber's salt for medium and pale shades. The temperature is raised to 180°F and finally to the boil. The steam is shut off, ammonia is added to adjust the pH to 8, and dyeing is continued for 15 to 30 minutes.

Two-tone effects on 100% wool. These effects can be produced by a one-bath method with selected dyes. The principle here is that selected reactive dyes, in the absence of a cationic agent, will dye the tips and abraded sections of the wool fiber, while leaving the fiber body undyed even after prolonged boiling. By combining milling and reactive dyes in the same bath, unusual results can be obtained. The dyebath is started with ammonium sulfate, boiled for 45 minutes, acetic acid is added, and boiling is continued for 15 minutes.

Leveling of acid milling dyes. In dyeing wool with acid milling colors, dyers have been hampered by the lack of suitable leveling agents. Certain nonionic compounds (eg, Univadine W) have now been developed which, by forming loose addition products with the dyes, bring about a marked change in the behavior of the dyebath. Leveling is promoted by competition between the dye sites of the wool and the leveling agent. Dyeing is conducted at the boil with addition of Glauber's salt and acetic acid.

Application of 1:2 metal-complex dyes to Orlon. In a normal dyebath for wool, these dyes have little effect on Orlon, but if large additions of salt are made and the temperature is increased to 260°F for one hour, fair to good exhaustion of the dye is obtained.

Dyeing filament nylon and high-bulk Orlon on sponge cores. These two fibers have caused difficulty in package dyeing because of excessive shrinkage of the yarn. The use of a sponge core on the holder allows the yarn to shrink without the package becoming too hard for the dye to penetrate.

Soluble sulfur dyes on cotton. The introduction of these water-soluble brands is a recent advance. Their soluble characteristic allows uniform diffusion of the dyes through the package prior to reduction and fixation on the fiber. The result is better level dyeing and softer yarn.

Phthalocyanine Blue on cotton. Sulfonated copper phthalocyanine (CI Direct Blue 86) has poor exhaustion and low water fastness when dyed normally. Investigations have been carried out to approach the dyeing

(*concluded on page 64*)

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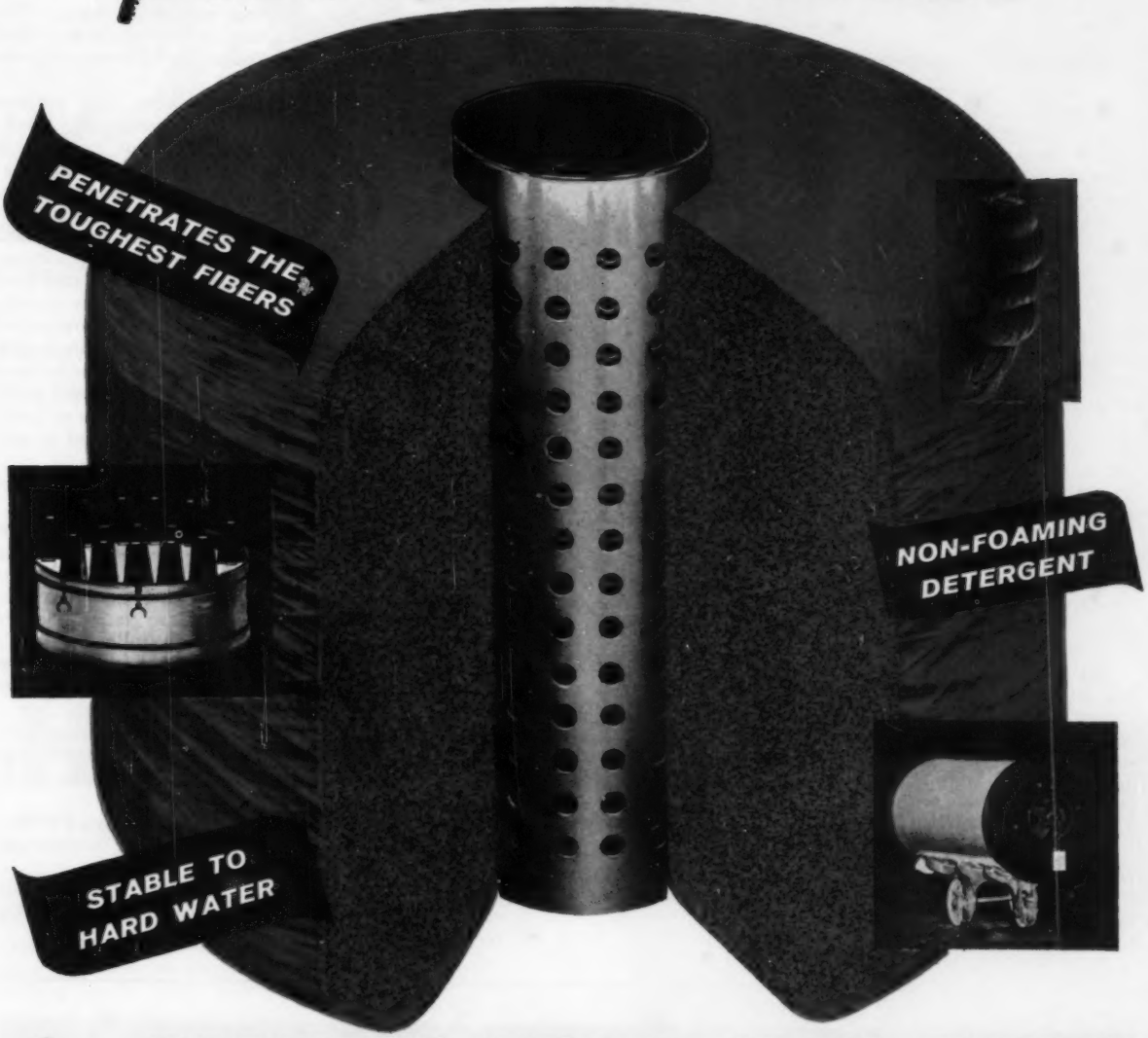

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Abstracts

(*concluded from page 62*)

of cotton from a different angle, ie, the coupling of the phthalocyanine pigment on the cotton itself. With the help of a mordant the intermediate from which the pigment is produced is absorbed by the cotton. With a short reducing treatment, the phthalocyanine pigment is formed in the fiber.

●

Infrared Fixation—an Alternative Means of Fixing Cibacron Dyeings

Ulrich, P, *Ciba Rev* 1961/3, 36-9.

The author refers to the so-called "cold pad-batch" technique for applying Cibacron dyes to cellulose fibers (see abstract, *Am Dyestuff Reptr 50*, #11, 33, 1961). This method provides for *wet* fixation of these dyes.

The possibilities of *dry* fixation have now been studied. Here energy transfer by means of radiation (infrared radiation in particular) claims interest as one of the possible lines of approach.

Other investigators have already reported that, after drying, Cibacron prints can be fixed within 12-30 seconds by infrared.

The author describes trials made in his laboratory with infrared radiation. A number of padding liquors were prepared with different Cibacron dyes according to the recipe for the well-known Thermofix method. After padding and drying, the fabrics were exposed to an infrared heating zone for various periods of time. Another set was similarly padded but fixed by the Thermofix method (for 4 minutes at 150°C).

Fixation by the infrared method was shown to occur considerably quicker, requiring 10 seconds for cotton and about 20 seconds for the quality of spun viscose used. It is pointed out that the fixation time will vary according to the distance from the infrared source.

The author concedes that the pad/Thermofix method has become "one of the principal pad-dyeing techniques", due in part to its high degree of fixation, excellent reproducibility and good coverage of dead cotton. However, when run as a continuous process, the pad/Thermofix method is not always carried out very efficiently, he says. This is largely due to the type of processing equipment available.

The use of infrared for fixation offers certain advantages besides the saving in time, the author claims: eg, smaller amounts of urea are needed, and the procedure is likely to yield "substantially better results" on rayon fabrics.

The fastness properties of dyes fixed by infrared are at least as high as those obtained by the Thermofix method, it is said.

Ten references to the literature are cited.

●

Terylene Bulked Yarns

Bruce, C S, *J Textile Inst 52*, P371-92, August 1961

Three basic methods are employed for bulking continuous-filament Terylene yarns. These are: false-twisting; stuffer-box crimping; and air texturing. This paper describes the production of false-twist, stabilized false-twist, Ban-Lon and Taslan yarns from Terylene and their properties and uses.

False-twist Terylene yarns have been used successfully where stretch is a prime requisite, eg, in half-hose, ski fabrics, leisure wear, etc; but progress in knitted outerwear has been confined to men's circular-garment-length production. High shrinkage, torque characteristics plus insufficiently regular yarn properties are held to be primarily responsible for the lack of progress in the more critical knitwear applications, and this has led to the development of the stabilized false-twist Terylene yarn, Crimplene. The low shrinkage of this yarn makes garment and fabric production, whether piece- or yarn-dyed, much simpler than with the high-shrinkage bulked yarns, and enables knitters to adopt techniques similar to those in use for wool. This yarn is being used initially in all forms of knitwear, but developments are also well advanced in woven fabrics.

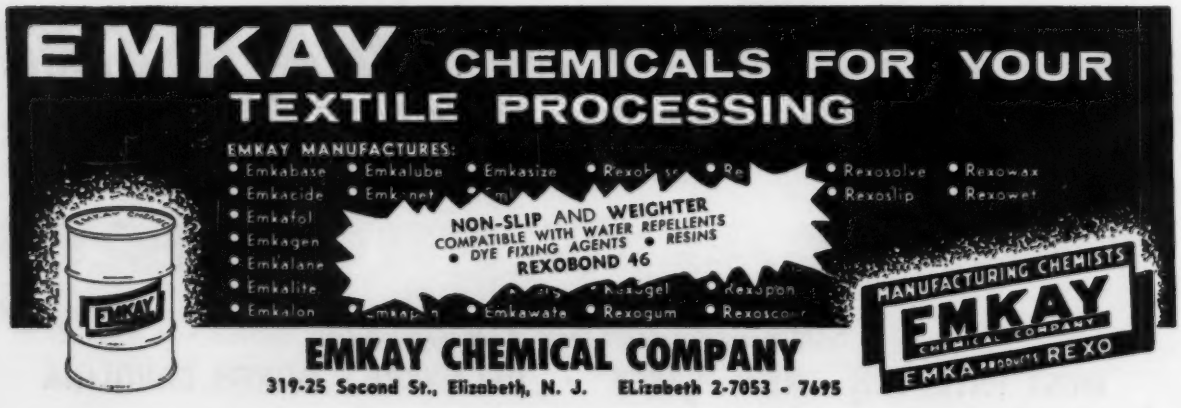
The ease with which Crimplene is yarn-dyed is one of its chief virtues.

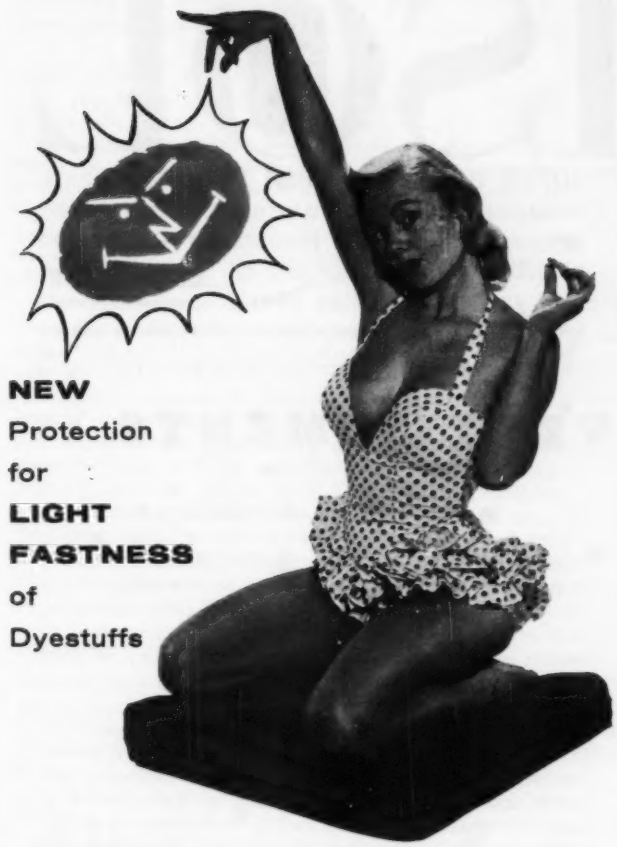
It is necessary to twist Terylene filament yarns prior to putting them through the Ban-Lon system, and the economic disadvantages which accompany this, together with the rather variable properties of the product, have limited progress with these yarns. Nevertheless, they have been used successfully for men's outerwear and some interlock dress fabrics, where the good pleating properties of Terylene are extremely useful.

Terylene yarns processed in the Taslan system have been used in shirtings and light-weight worsted-type skirting fabrics, but no progress has yet been made in knitwear.

Industrial overall fabrics using Terylene filament warp and Taslan filling yarns are becoming increasingly popular.

In making up garments from Terylene, it is desirable to use sewing threads with the same high performance in terms of durability and launderability.





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PATENT DIGEST

Paul Wengraf

PRINTING OF TEXTILES
with Neutrally Developable Colors D,2,04

U S Pat 2,970,030 (Ciba Ltd——Bolleter, Moser——Jan 31, 1961)

The preamble to this patent points out known methods of printing textiles with customary coupling components plus stabilized diazoamino compounds in the presence of alkali salts of halogenated fatty acids and of developing such prints in neutral steam. In these methods, labile diazoamino compounds containing solubilizing groups are used.

The current invention is based on the observation that the abovementioned alkali salts of halogenated fatty acids can be omitted, and textile prints developable in neutral steam can also be obtained by applying customary coupling compounds (examples in col 1, line 57—col 2, line 10) plus labile diazoamino compounds which are prepared by condensing a diazotized aromatic base with an aminobenzene carboxylic acid-sulfonic acid (formula in col 1, lines 40-45). Combinations of appropriate diazoamino compounds with coupling components are listed in col 3-4, lines 20 and following. The amount of alkali present in such a paste is given as more than 2 mols, calculated on the weight of coupling components.

•

PRINTING OF SOLUBLE VAT DYES——
Imidazolone or Vinylpyrrolidone Polymers Added D,2,04

U S Pat 2,970,880 (Am Cyanamid Co——Kaplan, Von——Feb 7, 1961)

It is reported that solubilized vat dyes obtained by converting leuco vat dyes into sulfuric acid ester salts (eg, indigosols, soluble vats, etc) frequently have the tendency to crystallize out of the printing paste. According to the current invention, this drawback may be avoided by incorporating a polymer of 1-3-bis hydroxymethyl imidazolone (prepared by condensing formaldehyde with ethylene urea and polymerizing by heating with acid) or a polymer of N-vinylpyrrolidone into the paste.

Example: one part of a solubilized dye (Soluble Vat Golden Yellow GK) plus 0.35 p polyvinylpyrrolidone (m w about 40.000) were made into a printing paste containing the other customary ingredients. After standing for more than four hours, no crystallization was observed while a portion of the dye had crystallized out within one hour standing and complete precipitation of the dye occurred when the above addition had been omitted.

•

VAT DYE PREPARATION
containing Polyvinylpyrrolidone C,5

U S Pat 2,971,812 (Am Cyanamid Co——Moran, Kaplan——Feb 14, 1961)

(See preceding abstract).

Concentrated aqueous pastes of vat dyes frequently tend to lose their fluidity and to become thixotropic in usage. It has been observed, according to the current patent, that the problem of thixotropy in vat dye pastes can be solved readily by incorporating at least 0.2% polyvinylpyrrolidone into the paste. Reportedly there is little use in raising the content of pyrrolidone to more than 3%.

Example: Two parts polyvinylpyrrolidone added to 100 p of a paste of 3-3′ dichloro indanthrone have the effect of keeping this paste fluid for weeks, while a paste in which this addition is omitted loses its fluidity after a few days.

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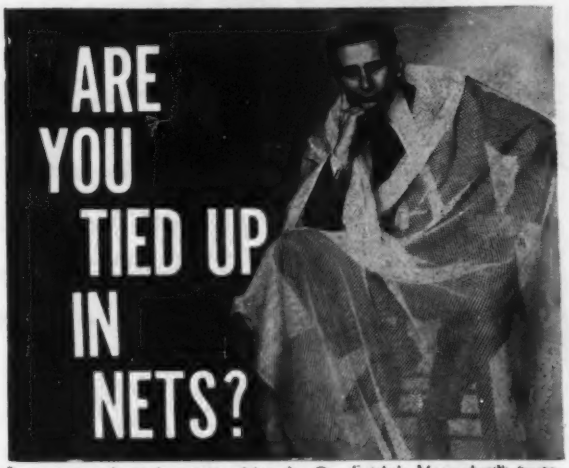

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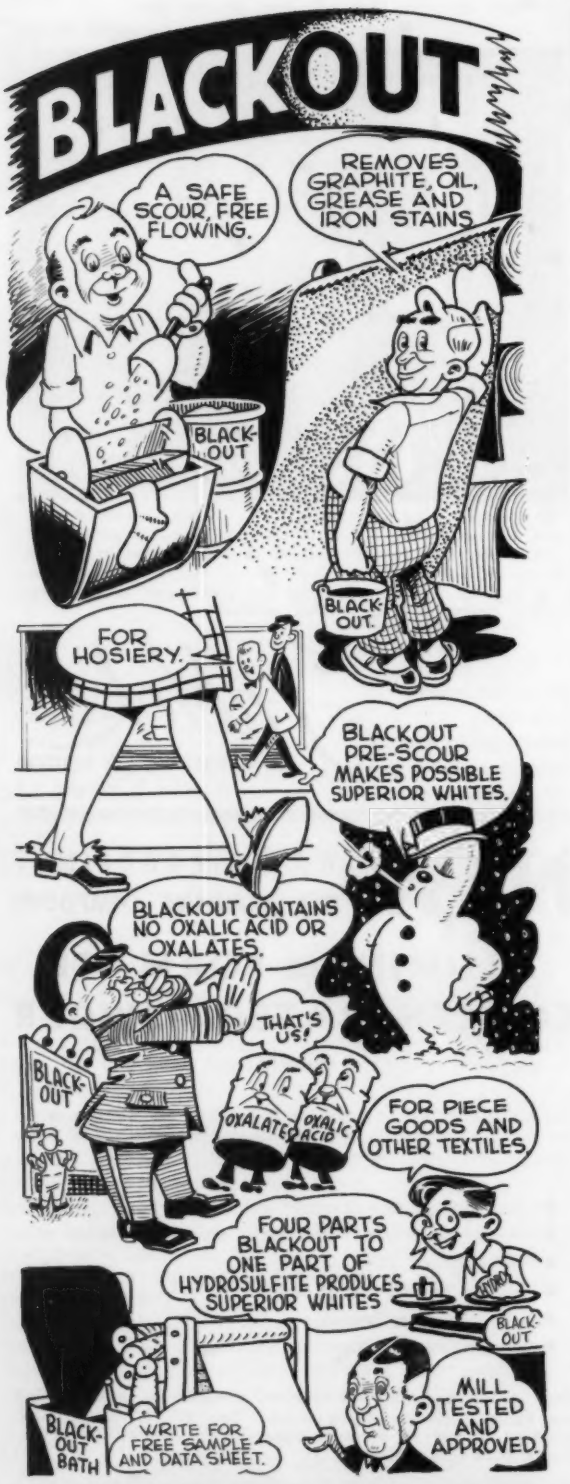

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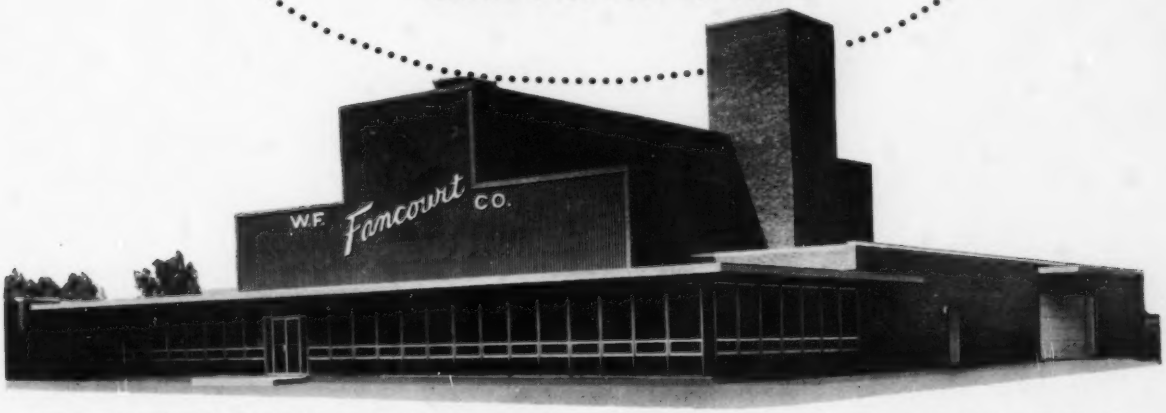

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Denims Take on New Fashion Colors

With the long-recognized blue denims continuing to be the largest seller, incorporating top fashion colors is now being proposed in what previously was known only as a work garment.

An effort to increase the volume on denims has caused both boys' and girls' wear manufacturers to introduce new shades. In boys' wear, particularly, encouraging success is being enjoyed although only 4 shades have been shown. The interest has been fairly evenly distributed between charcoal, green, tan and faded blue. In the misses' and girls' dungarees, red, turquoise and blue are reportedly good colors. Some mills have been experimenting with stretch denims. However, it is significant to note that vat-dyed merchandise maintains a sales lead over all other types of garments.

With this new market comes unlimited possibilities. Many college students now sport these tight, slim-cut jeans on the campus. They have had excellent acceptance for certain social events, informal parties and studying. One fear expressed—due to the inexpensiveness—is the fading of the bright, cheerful colors from laundering, perspiration, sunlight and other color hazards. This is where colorfastness and Vat Dyes by Cyanamid come in. For exceptionally fine working properties and superior end-use results in all fabrics, Vat Dyes—with Controlled Particle Size—are highly recommended. These tried-and-true Cyanamid dyes are available in every color and give the same uniform results time and time again.

The Miracle That is Wool

Among all the textile fibers used by man throughout the ages, some of the unique properties of wool have never been surpassed and others rarely equalled. This does not mean to imply that wool is a perfect fiber; it is not. Nor does it mean that other fibers do not have properties that would be desirable to have in wool.

The more we learn about wool through microscopical studies, the more impressed we become with its complex structure. For example, a nylon fiber appears to be homogeneous from end-to-end, having the same composition throughout its length. The composition of a wool fiber, on the other hand, varies from tip to the middle and to the root, and each section will dye differently under certain conditions.

Medullated East Indian wool fiber, sectioned longitudinally. Note complex interior structure.

The wool fiber is composed of several parts: the cuticle or outer-scale section; one or more membranes; the cortex or inner part of the fiber and, quite often, a medulla or channel in the center. The interior is composed of cortical cells which lie longitudinally within the fiber. A longitudinal slice of a wool fiber shows that the scale structure is keyed into the interior of the fiber in a very complex manner. All of these parts combine to give wool fiber its memory, tensile strength and abrasion resistance; its ability to felt; its softness of hand; its drape and its long life in a garment.

Since wool is a protein, it can be dyed with many classes of dyes. The shades which can be obtained range all the way from dazzling, fluorescents to the rich, bloomy navies or blacks.

Cyanamid has a wide range of dyes for coloring wool. Calcozine* Red BX can be used to produce the fluorescent pinks which have always been popular for baby sweaters and blankets. Calcocid* Blue AX Double and Calcocid Milling Fast Green CR produce pastel shades of turquoise, or nile green. When dyes with better fastness to light are required, the Calcofast* Wool and Calcofast Neutral dyes are recommended. When maximum fastness to light, washing, perspiration, and fulling are specified, there is a range of Calcochrome* dyes to fill these requirements. Whatever the requirements for shade and fastness, Cyanamid generally has excellent dyes to satisfy the needs of the textile industry.

The illustration shows a longitudinal slice of a medullated wool fiber, greatly enlarged to illustrate the interior structure which makes wool the miracle fiber that it is.

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